



Michigan
Transportation Asset
Management Council

**Transportation Asset Management Council
Bridge Committee Meeting Agenda
Thursday, January 24, 2018 @ 2:00 PM
Aeronautics Building- First Floor Conference Room
2700 Port Lansing Road
Lansing, Michigan**

Meeting Telephone Conference Line: 1-877-336-1828 Access Code: 8553654#

- 1. Welcome - Call to Order – Introduction**
- 2. Public Comments on Non-Agenda Items**
- 3. Additions or Deletions of Agenda Items**
- 4. Consent Agenda (*Action Item*)**
 - 4.1. Approval of the 12-20-18 Meeting Minutes (*Attachment 1*)
- 5. Update Items**
 - 5.1. TAMC Spring Conference Update – *Strong*
 - 5.1.1. TAMC Bridge Presentations – *Belknap (Attachment 2)*
 - 5.2. 2018 Michigan Roads and Bridges Annual Report
 - 5.2.1. Preliminary Bridge Condition Data – *Curtis*
 - 5.2.2. 2017 Investment Reporting for Bridges – *Belknap*
 - 5.3. TAMC Culvert Pilot Project
 - 5.3.1. APWA Public Works Project of the Year Award – *Belknap (Attachment 3)*
 - 5.3.2. Status of Invoices & Project Budget Update – *Belknap*
 - 5.3.3. Continuing Culvert Data Collection Efforts into Future
- 6. Public Comments**
- 7. Member Comments**
- 8. Adjournment:** *Next meeting is scheduled for February 21, 2019 @ 2:00 PM*

Committee Members: Chair: Rebecca Curtis, MDOT - Vice Chair: Keith Cooper, MDOT
Al Halbeisen, ACEC - Wayne Harrall, CRA - Bill McEntee, CRA - Gary Mekjian, MML
Brian Vilmont, Subject Matter Expert - Brad Wieferich, MDOT

**MINUTES
TRANSPORTATION ASSET MANAGEMENT COUNCIL
BRIDGE COMMITTEE MEETING**

December 20, 2018 at 2:00 p.m. – 4:00 p.m.
Aeronautics Building, 2nd Floor, Commission Conference Room
2700 Port Lansing Road
Lansing, Michigan

**** Frequently Used Acronyms List attached.**

Committee Member:

Keith Cooper, MDOT – Vice-Chair
Wayne Harrall, KCRC, via Telephone
Brian Vilmont, Prein & Newhof

Rebecca Curtis, MDOT – Chair
Bill McEntee, CRA, via Telephone
Brad Wieferich, MDOT

Support Staff:

Niles Annelin, MDOT
Chris Gilbertson, MTU, via Telephone
Polly Kent, MDOT

Roger Belknap, MDOT
Cheryl Granger, CSS, via Telephone
Gloria Strong, MDOT

Members Absent:

Al Halbeisen, OHM Advisors
Gary Mekjian, MML

Public Present:

None

1. Welcome - Call-To-Order - Introductions:

The meeting was called-to-order at 2:07 p.m. Everyone present was introduced and welcomed.

2. Public Comments on Non-Agenda Items:

None

3. Additions or Deletions of Agenda Items:

None

4. Consent Agenda (Action Item):

4.1. - Approval of the September 17, 2018 Meeting Minutes (Attachment 1)

Motion: B. Vilmont made a motion to approve the September 17, 2018 meeting minutes;
A. Halbeisen seconded the motion. The motion was approved by all members present.

5. Update Items:

5.1. – 2019 Schedule of Events and Participation Opportunities (Attachment 2)

A copy of the 2019 Schedule of Events was shared with the Committee. It is requested that committee members participate and sign up to attend one of the events, if possible.

5.2. – 2018 Michigan Roads and Bridges Annual Report Schedule (Attachment 3)

A schedule for the creation of the 2018 TAMC Annual Report was provided. It was agreed that R. Curtis would provide preliminary numbers for the February 21, 2019 committee meeting, final numbers to be approved March 21st (after the standard federal date for release of bridge data on March 15, 2019), for inclusion in the report to be approved by the TAMC at their April 9, 2019 meeting.

B. McEntee provided sample bridge data analysis graphs for the Committee to review. Since agencies are now reporting bridge data in the Investment Reporting Tool (IRT) TAMC can now provide bridge data analysis in the annual report. B. McEntee provided graphs from 2017 Reported Bridge Projects and would like to know if the Bridge Committee would like to place any of these graphs in the annual report. The Committee would like to combine “structural improvement” with “rehab” to make the graph clearer and to explain the work types. TAMC can put an asterisk explaining numbers for 2018, which are out of the ordinary because of the work on the Rouge River Bridge. B. McEntee will update the charts for January. The Committee liked the Agency Type by Improvement Type and the Investment by Agency Type graphs. Given that Michigan has more than 11,000 bridges, and work is only done on about 200 per year, clearly there is not enough bridge work undertaken per year and that is worth bringing to people’s attention.

Dave Jennett, who normally handles the TAMC Annual Report, is out of the office until February 1, 2019. N. Annelin will be handling the Annual Report until Mr. Jennett returns. Any related to the annual report items should now go to N. Annelin until further notice.

Action Item: B. McEntee will update the bridge graphs as discussed for the January Bridge Committee meeting.

5.3. – Update on Bridge Bundling Efforts – R. Curtis (Attachment 4)

The MDOT/County Road Association Bridge Bundling Working Session presentation from the County Road Association (CRA) Board of Directors meeting was provided and reviewed. R. Curtis gave a brief overview of this. MDOT is trying to create a Bridge Bundling Program. Agencies are having to make critical decisions with their funding on what they must fix when the funding does not cover all the necessary costs. The goal is for state and local bridge programs to have zero critical bridges by 2025. MDOT is working with local agencies to figure out ways to get this accomplished and figure out where to get the additional funding needed. Bridge agencies are looking at bundling, which is grouping similar bridges into a single contract to enable repetitive use of design, saving time and money on design and construction. MDOT Bureau of Bridges and Structures (BOBS) has a consultant who is assisting them. They are considering grants to help with funding. In March 2019, they want to bring to CRA their ideas and then on to the new administration by late March/April 2019. Another important issue was how do they remove bridges that may be deemed unnecessary, because they’ve already been closed for 10 or more years?

5.4. – TAMC Culvert Pilot Project (Attachments 5 and 6)

5.4.1. – Status of Invoices and Project Budget Update

There are still three regions that need to provide a final bill for their culvert inspection work. MTU's contract has been amended to cover the additional expenses incurred from the Culvert Pilot Project. Any unused funds from the culvert project are encumbered in contracts. Any unspent monies from this effort goes back into the Michigan Transportation Fund.

Action Item: R. Belknap and P. Kent will double check with MDOT Finance to see if TAMC can use the remaining funds towards activities that are culvert related in FY 2019.

5.4.2. – Culvert Pilot Data Integration into TAMC Interactive Map and Dashboards

It was requested and agreed by the Bridge Committee to have the Culvert Pilot data populated into the TAMC interactive map and dashboards even though all of the culverts have not been analyzed. Some agencies have culvert data that they may be willing to share even though they did not participate in the pilot. It will cost CSS approximately \$25,000 to do this. A budget request for this will need to be added to the January 2019 request to the MIC.

Action Item: R. Belknap will add this request to the 2020 budget.

5.4.3. – Synopsis of Culvert Pilot Project for 2018 Roads and Bridges Annual Report

Action Item: MTU will pull together a section regarding the Culvert Pilot Project to go into the TAMC Annual Report.

5.4.4. – American Public Works Association (APWA) Public Works Project of the Year Award; Nomination of Culvert Pilot

A recommendation was made to submit the Culvert Pilot Project under the Governmental Cooperation section of the APWA Public Works Project of the Year Award Requests for Nominations to receive an award for its efforts.

Action Item: R. Belknap and MTU will work together to complete and submit the application by the January 16, 2019 due date.

5.4.5. – Continuing Culvert Data Collection Efforts into Future

5.4.5.1. – Budget Requirements and Funding Sources

Depending on the flexibility of funds received, TAMC may be able to provide culvert data collection training modules next fiscal year. TAMC will need to ask for money for culvert data collection and training.

Action Item: Based upon the cost analysis done from the culvert pilot, C. Gilbertson will come up with an amount that TAMC can ask for in the TAMC budget request in January 2019 to the MIC.

5.4.5.2. – Data Collection Policy and Standards

A Culvert data collection policy and standards will need to be created stating the format, how it is collected, and what the measures will be. There needs to be a separate cost and policy by culvert size.

5.4.5.3. – Culvert Data Integrated into Asset Management Plan

MTU is going to leave a place holder for culvert data.

5.5. – “The Bridge” Newsletter Article/TAMC Culvert Pilot Project Report – C. Gilbertson

C. Gilbertson and S. Bershing will do the article for the next “The Bridge” Newsletter. They will do the article on the Culvert Pilot Project and use the Executive Summary for the article and add a few interviews.

6. Public Comments:

None

7. Member Comments:

None

8. Adjournment:

B. Wieferich made a motion to adjourn the meeting; B. Vilmont seconded the motion. The motion was approved by all members present. The meeting adjourned at 3:53 p.m. The next meeting will be held January 24, 2019, at 2:00 p.m.-4:00 p.m., MDOT Aeronautics Building, 2nd Floor Commission Conference Room, Lansing.

TAMC FREQUENTLY USED ACRONYMS:

AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
ACE	ADMINISTRATION, COMMUNICATION, AND EDUCATION (TAMC COMMITTEE)
ACT-51	PUBLIC ACT 51 OF 1951-DEFINITION: A CLASSIFICATION SYTEM DESIGNED TO DISTRIBUTE MICHIGAN’S ACT 51 FUNDS. A ROADWAY MUST BE CLASSIFIED ON THE ACT 51 LIST TO RECEIVE STATE MONEY.
ADA	ADULTS WITH DISABILITIES ACT
ADARS	ACT 51 DISTRIBUTION AND REPORTING SYSTEM
BTP	BUREAU OF TRANSPORTATION PLANNING (MDOT)
CFM	COUNCIL ON FUTURE MOBILITY
CPM	CAPITAL PREVENTATIVE MAINTENANCE
CRA	COUNTY ROAD ASSOCIATION (OF MICHIGAN)
CSD	CONTRACT SERVICES DIVISION (MDOT)
CSS	CENTER FOR SHARED SOLUTIONS

DI	DISTRESS INDEX
ESC	EXTENDED SERVICE LIFE
FAST	FIXING AMERICA'S SURFACE TRANSPORTATION ACT
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FOD	FINANCIAL OPERATIONS DIVISION (MDOT)
FY	FISCAL YEAR
GLS REGION V	GENESEE-LAPEER-SHIAWASSEE REGION V PLANNING AND DEVELOPMENT COMMISSION
GVMC	GRAND VALLEY METRO COUNCIL
HPMS	HIGHWAY PERFORMANCE MONITORING SYSTEM
IBR	INVENTORY BASED RATING
IRI	INTERNATIONAL ROUGHNESS INDEX
IRT	INVESTMENT REPORTING TOOL
KATS	KALAMAZOO AREA TRANSPORTATION STUDY
KCRC	KENT COUNTY ROAD COMMISSION
LDC	LAPTOP DATA COLLECTORS
LTAP	LOCAL TECHNICAL ASSISTANCE PROGRAM
MAC	MICHIGAN ASSOCIATION OF COUNTIES
MAP-21	MOVING AHEAD FOR PROGRESS IN THE 21 ST CENTURY (ACT)
MAR	MICHIGAN ASSOCIATION OF REGIONS
MDOT	MICHIGAN DEPARTMENT OF TRANSPORTATION
MDTMB	MICHIGAN DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET
MIC	MICHIGAN INFRASTRUCTURE COMMISSION
MITA	MICHIGAN INFRASTRUCTURE AND TRANSPORTATION ASSOCIATION
MML	MICHIGAN MUNICIPAL LEAGUE
MPO	METROPOLITAN PLANNING ORGANIZATION
MTA	MICHIGAN TOWNSHIPS ASSOCIATION
MTF	MICHIGAN TRANSPORTATION FUNDS

MTPA	MICHIGAN TRANSPORTATION PLANNING ASSOCIATION
MTU	MICHIGAN TECHNOLOGICAL UNIVERSITY
NBI	NATIONAL BRIDGE INVENTORY
NBIS	NATIONAL BRIDGE INSPECTION STANDARDS
NFA	NON-FEDERAL AID
NFC	NATIONAL FUNCTIONAL CLASSIFICATION
NHS	NATIONAL HIGHWAY SYSTEM
PASER	PAVEMENT SURFACE EVALUATION AND RATING
PNFA	PAVED NON-FEDERAL AID
PWA	PUBLIC WORKS ASSOCIATION
QA/QC	QUALITY ASSURANCE/QUALITY CONTROL
RBI	ROAD BASED INVENTORY
RCKC	ROAD COMMISSION OF KALAMAZOO COUNTY
ROW	RIGHT-OF-WAY
RPA	REGIONAL PLANNING AGENCY
RPO	REGIONAL PLANNING ORGANIZATION
SEMCOG	SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS
STC	STATE TRANSPORTATION COMMISSION
STP	STATE TRANSPORTATION PROGRAM
TAMC	TRANSPORTATION ASSET MANAGEMENT COUNCIL
TAMCSD	TRANSPORTATION ASSET MANAGEMENT COUNCIL SUPPORT DIVISION
TAMP	TRANSPORTATION ASSET MANAGEMENT PLAN
TPM	TRANSPORTATION PERFORMANCE MEASURES
UWP	UNIFIED WORK PROGRAM

S:/GLORIASTRONG/TAMC FREQUENTLY USED ACRONYMS.11.27.2018.GMS



Berrien County Road Department

2860 E. Napier Avenue
Benton Harbor, MI 49022

Phone: 269-925-1196
Fax: 269-925-8098
www.bcroad.org

Jason Latham

Director

January 16, 2019

Beckie Curtis and Brian Zakrzewski,

I am writing on behalf of David Juntunen and myself. In 2018 the Berrien County Road Department (BCRD) worked with The Kercher Group to develop a Bridge Asset Management Plan in accordance with TAMC guidance. The asset management plan includes several tools to help our road department manage our bridges. Included in the plan are a forecasting tool, a bridge condition viewer, and Google map showing our good, fair, and poor bridges.

We would be more than happy to share our asset management plan at the conference. You will find attached the Bridge Asset Management Plan that was developed. Thank you for your consideration. I look forward to your response.

Sincerely,

Jason Latham, Director
Berrien County Road Department

CC: David Juntunen

Berrien County Road Department
Asset Management Plan
For
County-Maintained Bridge Structures



Submitted by:
The Kercher Group, Inc.

December 8, 2018



COVER LETTER



December 8, 2018

Mr. Jason Latham, P.E.
Managing Director
Berrien County Road Department
2860 E. Napier Avenue
Benton Harbor, MI 49022

RE: Final Report - Asset Management Plan for County-Maintained Bridges

Dear Mr. Latham:

The Kercher Group Incorporated (Kercher) is pleased to provide this Final Report Titled, Berrien County – Asset Management Plan for County-Maintained Bridges. We hope you find this report useful to manage your 103 bridges and to show your commitment to bridge asset management to the Michigan Transportation Asset Management Council (TAMC) and Local Agency Bridge Program (LAPB). As part of this project, we are also pleased to provide the Kercher Bridge Forecaster© tool to help you manage bridge specific preventive maintenance, rehabilitation, and replacement projects in a five or ten-year program, the Kercher Bridge Condition Viewer© tool that you can use to view individual bridge condition rating trends for you bridges on the National Bridge Inventory (NBI), and the Berrien County Road Department bridge condition Google map showing the location and condition of your NBI bridges. We hope you find this report and these tools valuable as you work towards your strategic goals and objectives.

Should you have any questions or require additional information, please don't hesitate to reach out to Dave Juntunen or me (djuntunen@kerchergroup.com or svarnedoe@kerchergroup.com) at your earliest convenience.

Sincerely,

William S. Varnedoe, P.E, Principal
The Kercher Group, Incorporated

CONTENTS

Introduction and Purpose 2

Berrien County Road Department Bridge Goals 2

Berrien County Road Department Bridge Objectives 2

Performance Measures..... 2

Bridge Assets 3

Condition analysis 4

 Ten-year Condition Trend for Berrien County Road Department NBI Bridges..... 5

Bridge Deterioration Model..... 7

Risk Management 11

Preservation Strategy..... 12

 Project Prioritization Criteria 13

 Rehabilitation and Replacement Program..... 13

 Preservation Program 13

Implementation of the Strategy 14

 Cost Estimates..... 16

 Five-Year Annual Cost Projection..... 16

 Identify Funding Sources..... 16

 Operations and Maintenance Plan—Annual Activities/5-Year Program..... 16

Appendix A – Summary of Preservation Criteria 18

Appendix B – Fiscal Year 2018 Local Agency Bridge Projects Average Cost 21

Appendix C – Kercher Bridge Forecaster© 22

Appendix D – Kercher Bridge Viewer© 23

Appendix E – BCRD Google Map of Good, Fair, and Poor Bridges..... 24

INTRODUCTION AND PURPOSE

The Berrien County Road Department (BCRD) seeks to implement a cost-effective program of preventive maintenance, rehabilitation, and replacement to maximize the useful service life of the local bridges under their jurisdiction. The BCRD recognizes that limited funds are available for improving the bridge network and this strategic bridge plan including preventive maintenance will be key to their success. Preventive maintenance is a more effective use of funds than the costly alternative of major rehabilitation or replacement, and they seek to identify those bridges that will benefit from a planned maintenance program, while doing risk management to identify and schedule poor, serious, and critical bridges for rehabilitation and replacement.

This report is an asset management plan for BCRD highway bridges meeting the 20-foot total structure length requirements of the Federal National Bridge Inventory. It includes bridge and culvert type structures. The report follows the guidelines provided by the Michigan Transportation Asset Management Council (TAMC) Asset Management Guide for Local Agency Bridges in Michigan.¹ This report uses data from the Federal Highway Administration (FHWA) National Bridge Inventory (NBI) Website,² the Michigan Department of Transportation Mi-Bridge website, and a data file provided by the Michigan Department of Transportation to be used with TAMC Template For Bridge Asset Management Plan developed by the Center For Technology and Training (CTT) at Michigan Technological University (MTU).

BERRIEN COUNTY ROAD DEPARTMENT BRIDGE GOALS

The goal of the BCRD is to reduce the number of serious and poor bridges (NBI General Condition Rating (GCR) 3 and 4, respectively), mitigate scour critical bridges, and to preserve good and fair bridges to keep them from becoming poor to move people and commerce in the county safely and efficiently.

BERRIEN COUNTY ROAD DEPARTMENT BRIDGE OBJECTIVES

The BCRD objectives for implementing this preservation plan are:

- Achieve and maintain 90% of BCRD bridges rated good or fair within five years.
- Strengthen, repair, or replace all BCRD bridges and NBI length culverts rated in serious (NBI GCR 3) within 7 years.
- Strengthen, mitigate, armor, or replace all scour critical bridges having extensive scour (Item 113 = 2) to stabilize the foundations.
- Mitigate or replace scour critical bridges (NBI Item 113 = 3) when the structure is scheduled for rehabilitation or replacement due to major component condition ratings or other operational or functional needs.

PERFORMANCE MEASURES

Several metrics will be used to assess the effectiveness of the preservation plan. The BCRD will monitor and report the annual change in the number of its bridges rated good, fair, and poor as rated by the NBI GCRs for the bridges. A bridge rating is determined from the lowest of the deck, superstructure, or

¹ Asset Management Guide for Local Agency Bridges, Michigan Asset Management Council, May 2011.

² Federal Highway Administration National Bridge Inventory Website – Download NBI ASCII Files.

<https://www.fhwa.dot.gov/bridge/nbi/ascii.cfm>

Berrien County Michigan

Asset Management Plan for County-Maintained Bridges

substructure ratings, or if the structure is a culvert type structure, the culvert rating. Excel charts will be used to monitor progress toward a long-range objective of having 90% of their bridges rated good or fair. The BCRD will also monitor the number of scour critical bridges and mitigate high priority needs to stabilize foundations.

The preservation plan is also intended to extend the period that bridges remain in good and fair condition, thereby increasing their useful service life and reducing future maintenance costs. The BCRD will track the number of bridges that turn poor and are expected to turn poor during the preservation plan period. The BCRD will track the South-West Region local agency Markov transition probabilities and strive to keep county deterioration rates lower than the statewide average for local agency owned bridges.

BRIDGE ASSETS

The BCRD is responsible for 103 local bridges. Table 1 shows the type of bridges and NBI length culverts the BCRD has along with number of bridges in each category and 2018 condition ratings. The bridge inventory data was obtained from MDOT Mi-BRIDGE and other sources.

Bridge Type	Number of Bridges				2018 Condition		
	Total	Struct. Defic.	Posted	Closed	Poor/ SD	Fair	Good
Concrete – Culvert	11	0	0	0	0	1	10
Prestressed concrete – Box beam/girders—multiple	37	1	1	0	1	13	23
Prestressed concrete – Box beam/girders—single/spread	1	0	0	0	0	0	1
Prestressed concrete – Multistringer	11	0	1	0	0	1	10
Prestressed concrete continuous – Box beam/girders—single/spread	1	0	0	0	0	1	0
Steel – Culvert	11	4	5	0	4	6	1
Steel – Multistringer	12	4	6	0	4	7	1
Steel – Truss—thru and pony	1	0	0	0	0	1	0
Steel continuous – Multistringer	3	1	1	0	1	2	0
Timber – Culvert	4	0	2	0	0	4	0
Timber – Multistringer	4	2	3	0	2	1	1
Timber – Slab	7	2	2	0	2	3	2
Total SD/Posted/Closed		14	21	0			
Total	103				14	40	49
Percentage (%)		14%	20%	0	14%	39%	48%

Table 1 - Distribution of the Berrien County Road Department Bridge Population and Condition.

BCRD bridge types and materials are also shown in the pie chart shown in Figure 1. Concrete bridges are shown in shades of tan/orange, steel bridges are shown in shades of blue, and timber bridges are shown in shades of green. Typical of most highway agencies in Michigan, the majority of BCRD bridges are concrete.

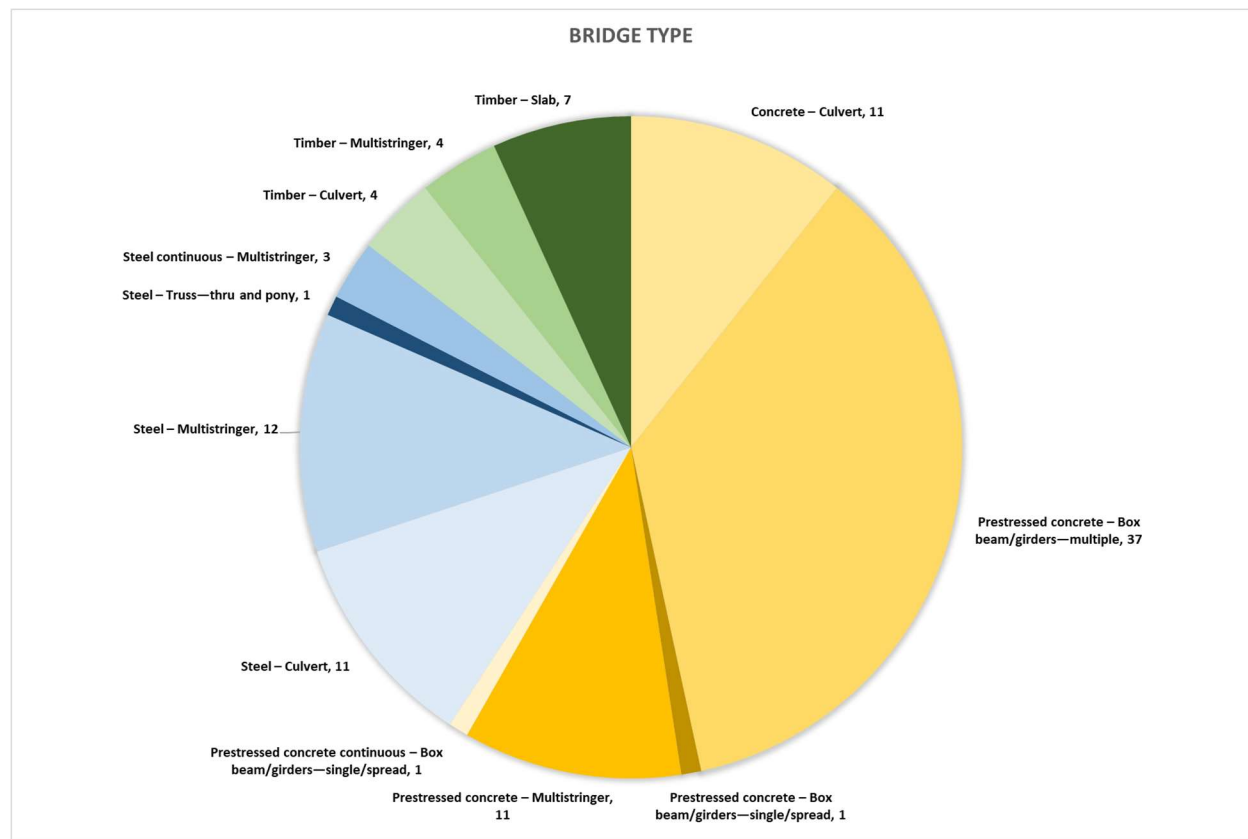


Figure 1 – Berrien County Road Department Bridge Type Pie Chart

CONDITION ANALYSIS

Of the BCRD’s 103 structures, the distribution of overall condition is: 49 (48%) are good, 40 (39%) are fair; and 14 (14%) are poor (Structurally Deficient) as shown in Figure 2. Good is defined as a bridge rated 7 through 9, fair is defined as a bridge rated 5 or 6, and poor is defined as bridge rated 4 or below on the NBI GCR system. This is the same metric used by the Michigan Department of Transportation and the Federal Highway Administration (Note: The FHWA counts by deck area).

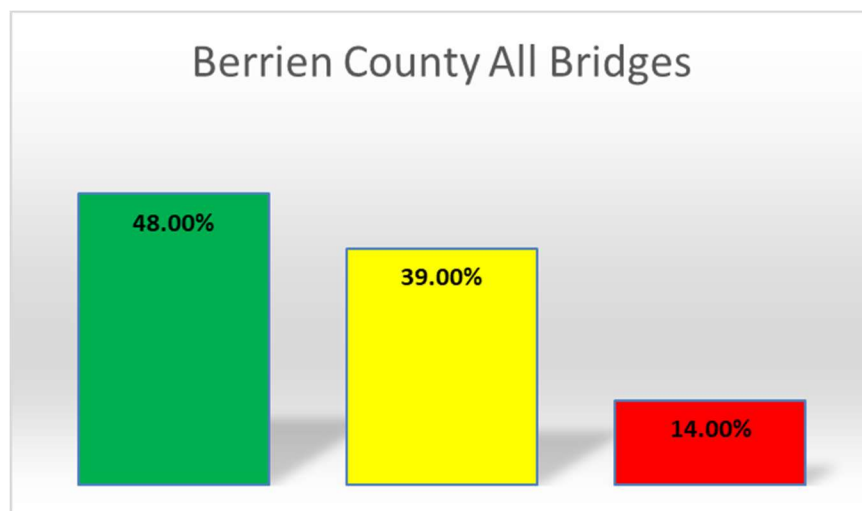


Figure 2- Berrien County Bridges Percent Good, Fair, Poor.

Berrien County Michigan

Asset Management Plan for County-Maintained Bridges

Berrien County has similar percentages to the statewide local agency conditions which are 86% good or fair and 14% poor.

Bridges in poor (or worse) condition typically need major rehabilitation or replacement. Bridges in fair condition typically are preventive maintenance candidates, and bridge in good condition often only needs cyclic maintenance activities.

Ten-year Condition Trend for Berrien County Road Department NBI Bridges.

The Federal NBI condition data was analyzed over the past ten years (2007 through 2017) to show the ten-year trend for BCRD bridge condition ratings which is shown as a column chart for each NBI condition rating in Figure 3 and a line chart in Figure 4 for overall bridge condition trends as measured by bridges in good or fair condition (non-structurally deficient.) Figure 3 shows the column chart for each NBI GCR condition rating over the past ten years. For the most part, condition ratings over the past ten years have been relatively stable. As of 2017 all County bridges rated 2 (Critical) have been improved or replaced. The number of bridges rated 3 (Serious) has increased slightly to 7 bridges rated serious in 2018 which is a point of concern. The number of bridges rated 4 (Poor) has also increased slightly to 7 bridges rated poor in 2018.

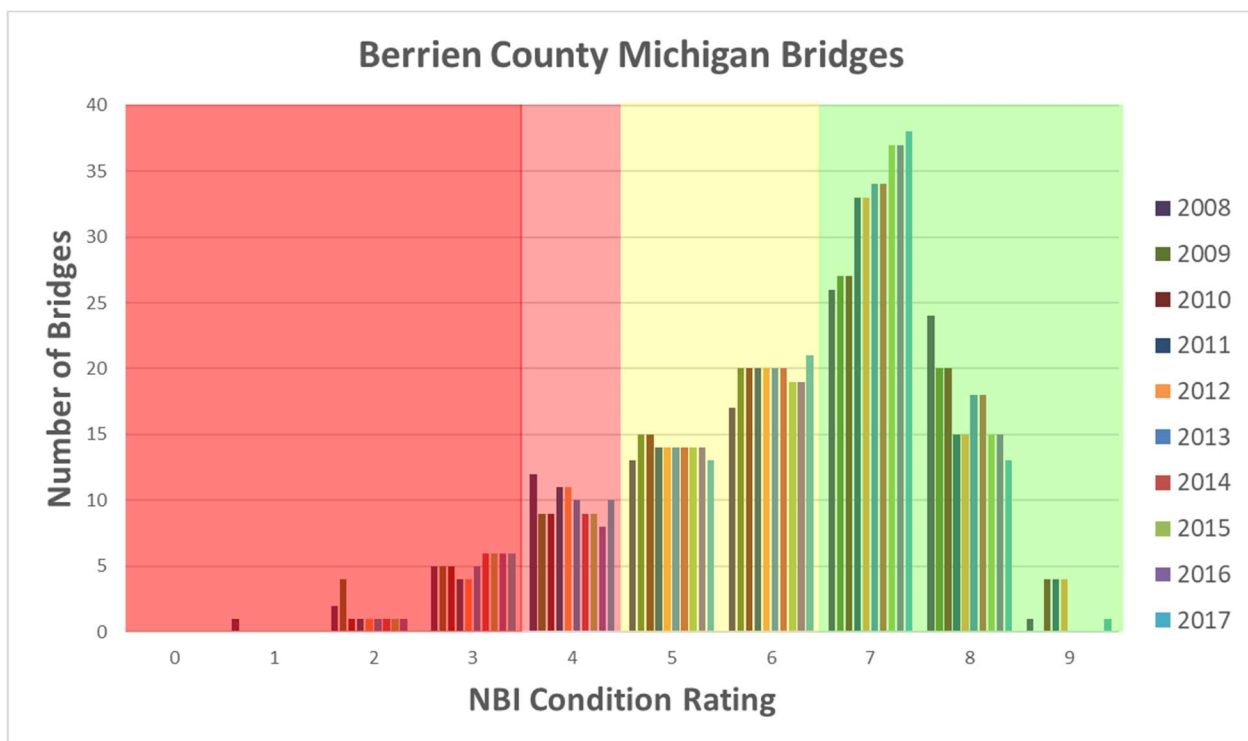


Figure 3 – Column Chart of BCRD Bridge Condition Ratings (2008 – 2017)

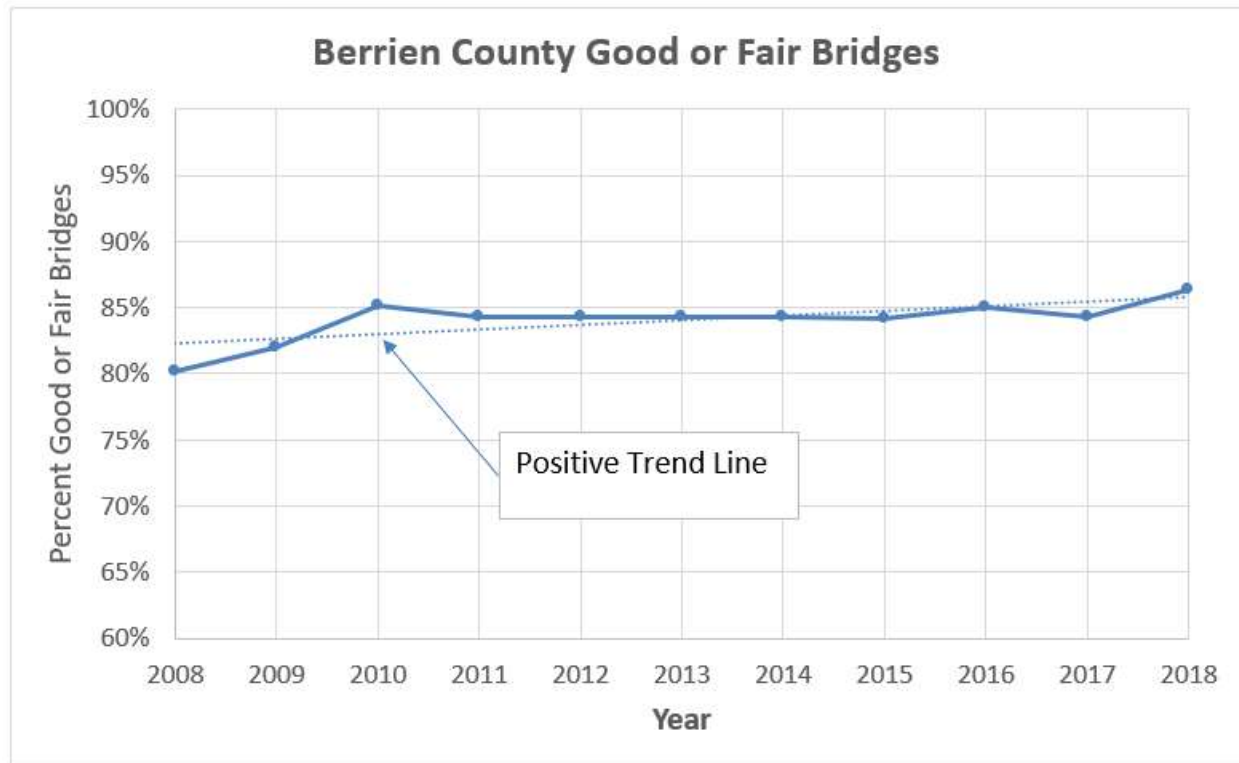


Figure 4 – Percentage of BCRD Bridges Rated Good or Fair.

The BCRD good and fair bridges line chart shows a 10-year trend from 2008 to 2018. The condition increased from 80% in 2008 to 86% in 2018 with a mild positive linear trend over those years.

The BCRD has several large deck area bridges. Because of the large expense needed to rehabilitate or replace these structures more detailed analysis and management is done to preserve them. Figure 5 shows a histogram of the BCRD bridge deck area. Five bridges with deck area exceeding 10,000 square feet are labeled in the chart, highlighted green if in good condition, highlighted yellow if in fair condition, and highlighted red if in poor condition.

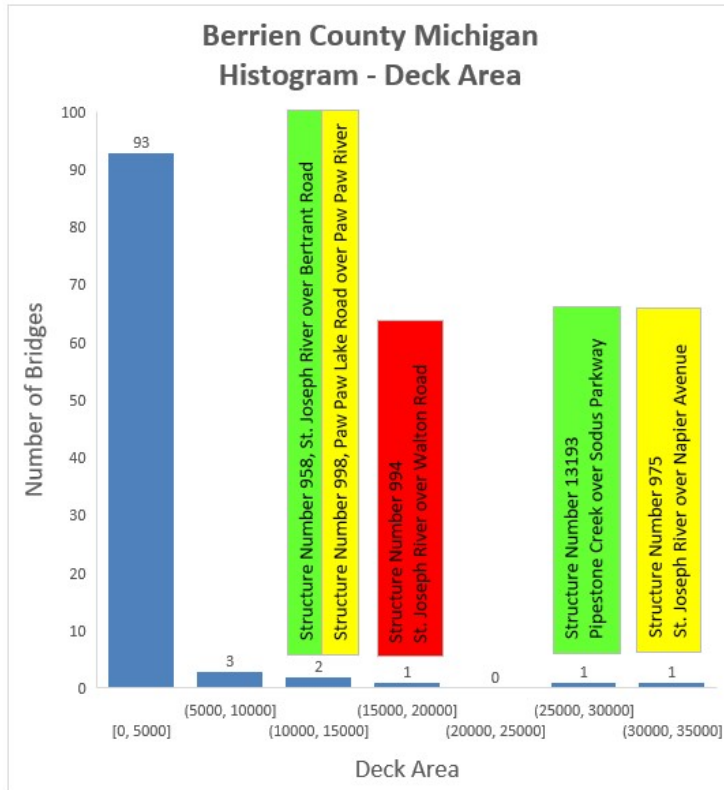


Figure 5 – BCRD Large Deck Area Bridges Histogram.

BRIDGE DETERIORATION MODEL

To forecast future bridge condition a deterioration model needs to be developed to represent BCRD bridges. Markov transition probabilities are a common method for creating bridge deterioration models. This method is used by the Michigan Department of Transportation. BCRD bridge deterioration rates were reviewed but the amount of data was lacking to develop deterioration models (curves), so statewide local agency bridge condition data and the South-West Region local agency bridge condition data was used to create deterioration models (curves) for BCRD. Figure 6 shows a four-year average deterioration curve for Michigan local agency bridge decks. This chart shows the time for a deck to become poor (time to poor) (GCR 4) is 49 years. Figure 7 shows a four-year average deterioration curve for Michigan local agency bridge superstructures. This chart shows the time for a superstructure to become poor (time to poor) (GCR 4) is 48 years. Figure 8 shows a four-year average deterioration curve for Michigan local agency bridge substructures. This chart shows the time for a substructure to become poor (time to poor) (GCR 4) is 51 years. Note that these are similar values and the three major components appear to deteriorate at similar rates. Figure 9 shows a four-year average deterioration curve for Michigan local agency bridge length culverts. This chart shows the time for a bridge length culvert to become poor (time to poor) (GCR 4) is 58 years, indicating in the past four years bridge length culverts appear to have a slower deterioration rate than bridges. This information can be used when making decisions on projects.

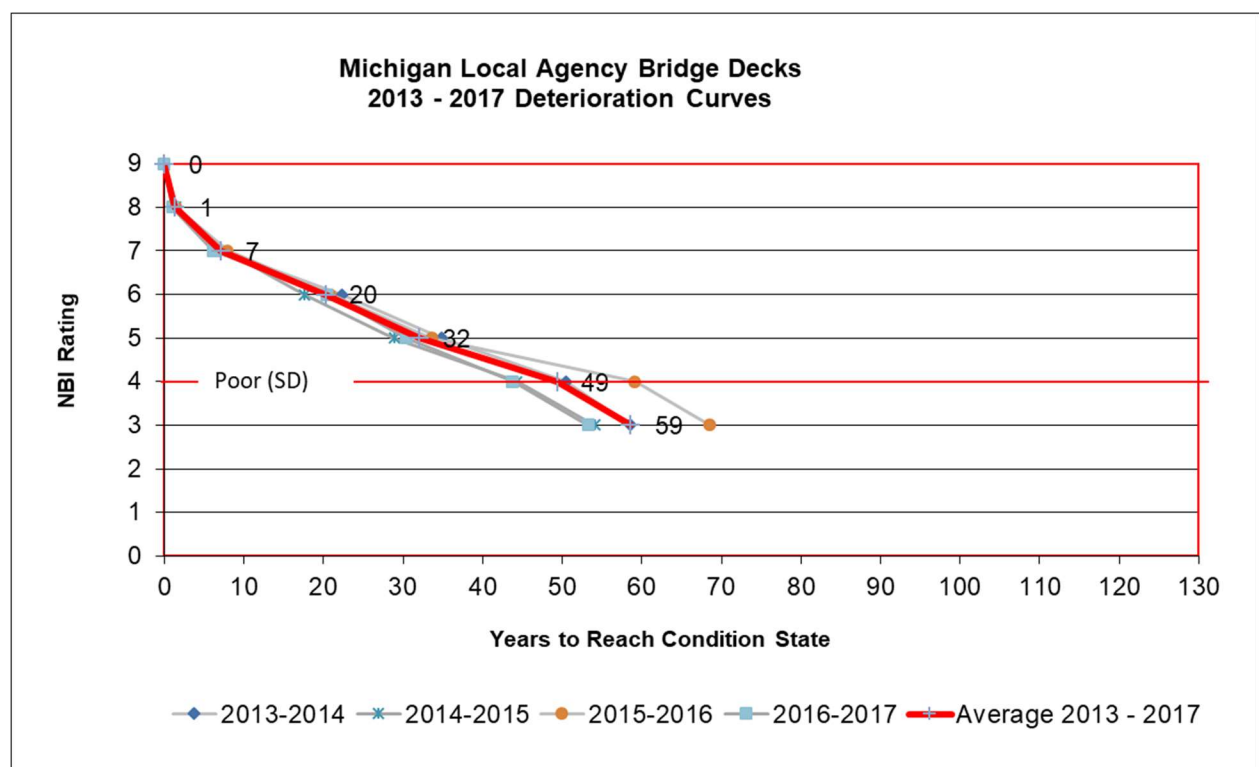


Figure 6 – Michigan Local Agency Bridge Deck Deterioration Model.

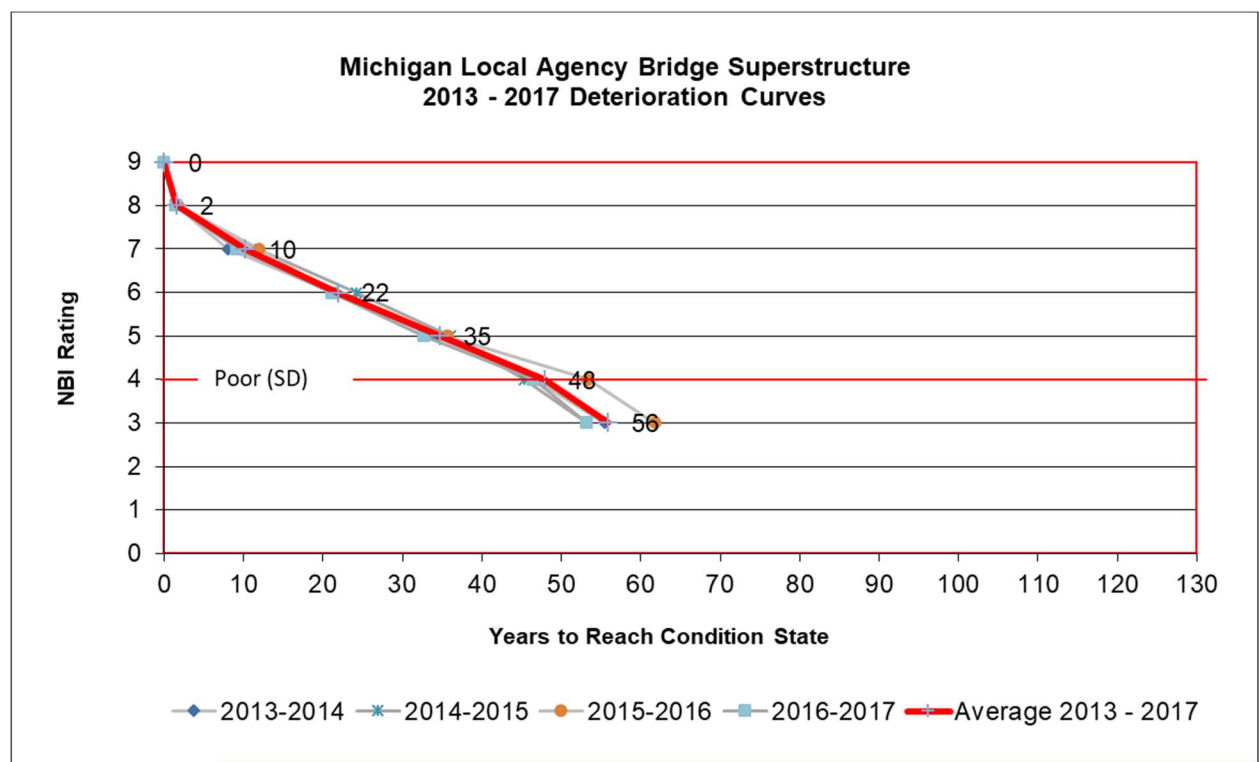


Figure 7 - Michigan Local Agency Bridge Superstructure Deterioration Model.

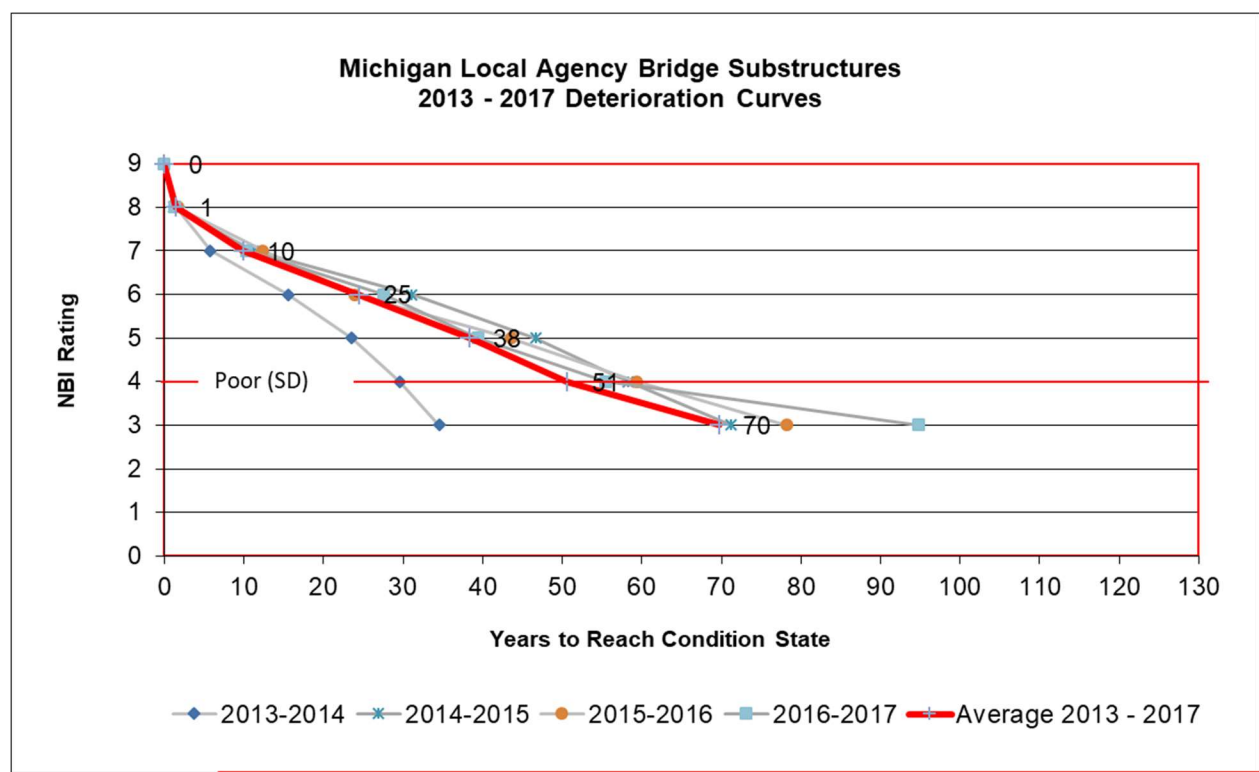


Figure 8 - Michigan Local Agency Bridge Substructure Deterioration Model.

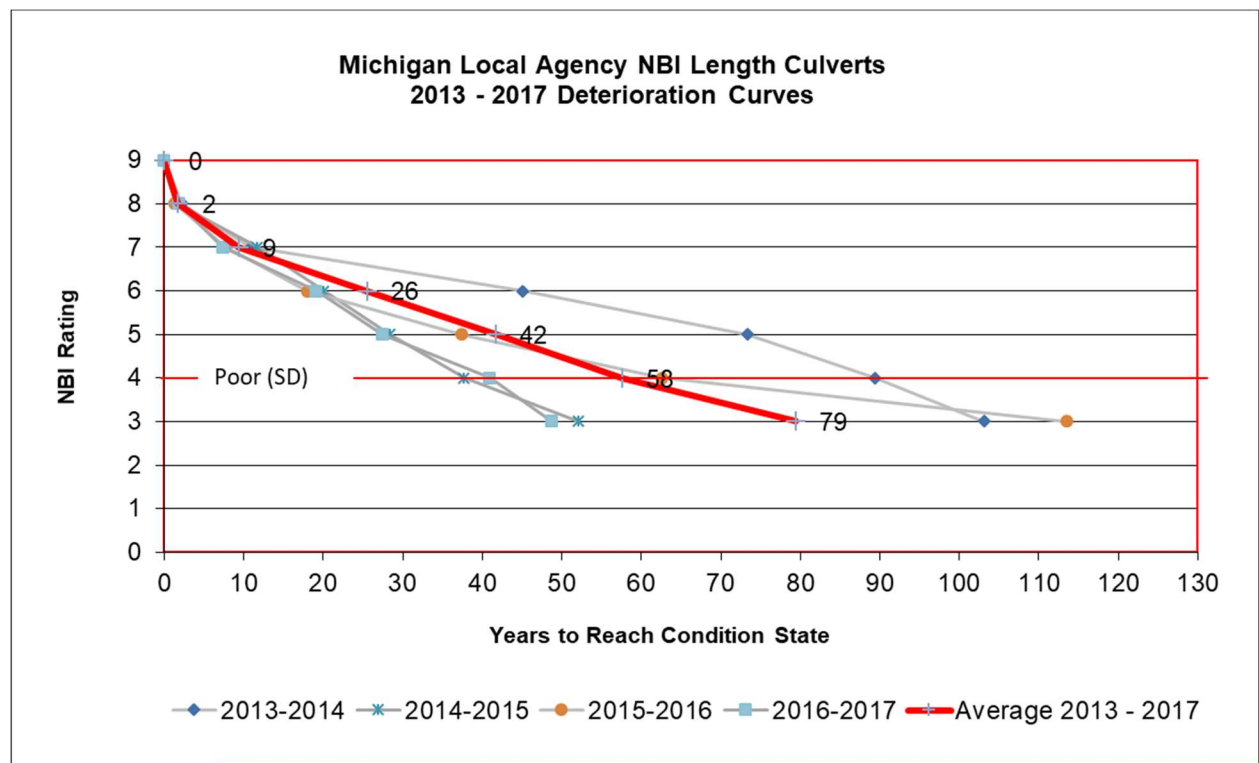


Figure 9 - Michigan Local Agency Bridge Length Culvert Deterioration Model.

Figure 10 shows a four-year average deterioration curve for local agency bridges in the South-West Region. The chart shows the time for a bridge to become poor (time to poor) (GCR 4) is 58 years, indicating local agency bridges in the South-West region deteriorate slower than the statewide average in the last four years. The grey lines in the chart show values for each year. Notice the variability in curves indicating that there is considerable variability in the deterioration curves from years to year. This is to be expected because the data set is smaller, and it also demonstrates that forecasting that uses this estimated deterioration curve is not an exact science, and it should be expected that there will be variability in forecasted condition versus actual from year to year.

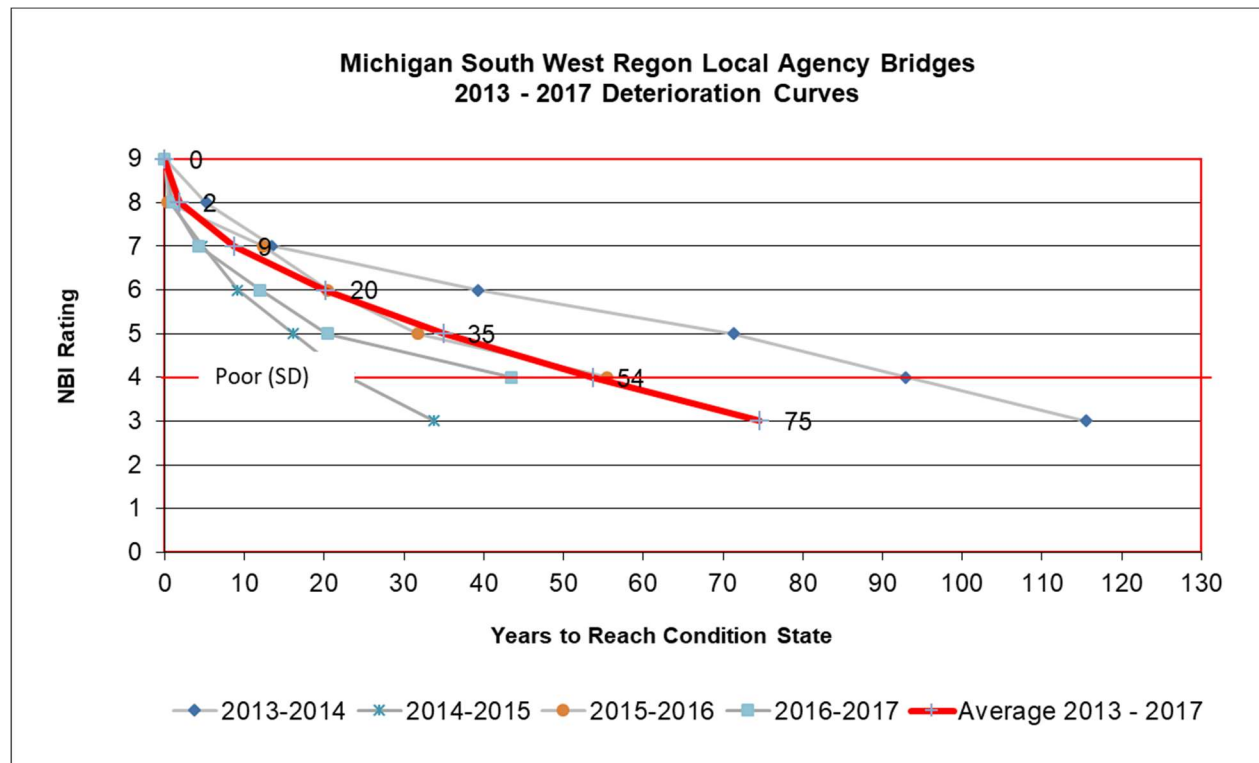


Figure 10 - Michigan South-West Region Local Agency Bridge Deterioration Model.

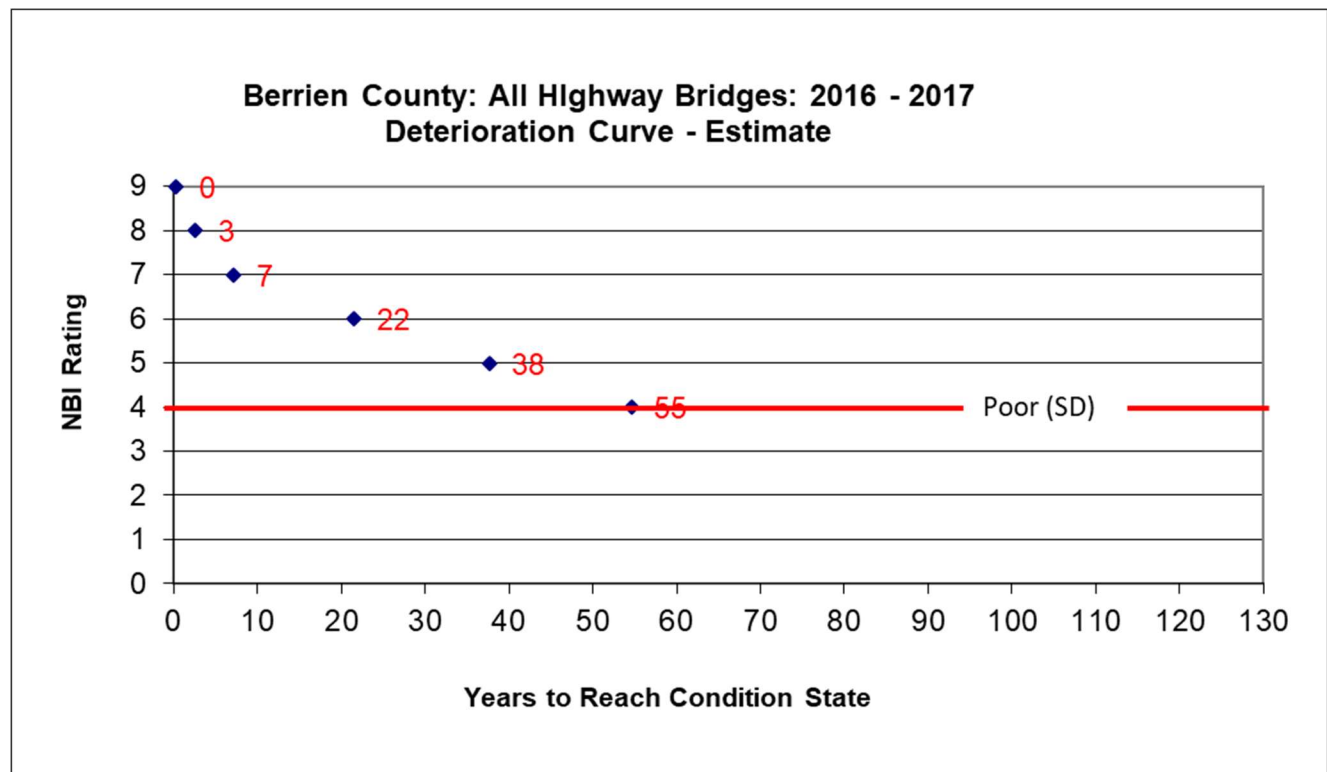


Figure 11 – Berrien County Road Department Local Agency Bridge Deterioration Model.

Figure 11 shows the 2016-2017 bridge deterioration curve. This year was the only year there was enough data to produce the curve. Although this is not enough information to make a conclusive statement about the deterioration rates in Berrien County, this curve is similar to the South-West Region local agency bridge deterioration curves, which gives some degree of confidence that the South-West Region deterioration curves may be representative of Berrien County.

For forecasting, the South-West Region deterioration curves are recommended to be used.

RISK MANAGEMENT

Risk is one way to prioritize bridge repair, retrofit, rehabilitation, and replacement needs. The BCRD recognizes that the potential risks associated with bridges generally fall into several categories:

- Personal injury and property damage resulting from a bridge collapse or partial failure;
- Loss of access to a region or individual properties resulting from bridge closures, restricted load postings, or extended outages for rehabilitation and repair activities; and
- Delays, congestion, and inconvenience due to serviceability issues, such as poor-quality riding surface, loose expansion joints, or missing expansion joints.

The BCRD addresses these risks by implementing a regular bridge inspection program to assure public safety and identify bridge needs. The BCRD administers the biennial inspection of its bridges in accordance with NBIS and MDOT requirements. The inspection reports document the condition of the BCRD's bridges and are used to monitor advancing deterioration.

Risk can be described as the potential for unplanned adverse events to impact a bridge in a way that causes unacceptable transportation system performance. Risk management includes identification of

risks, prioritization of risks, mitigation planning, monitoring, and assessment of likelihood of occurrence and impact of consequence. BCRD has 7 bridges rated serious (NBI GCR 3) and 7 bridges rated poor (NBI GCR 4). These bridges were prioritized using risk assessment. The structures were prioritized for community importance by Average Daily Traffic (ADT). Likelihood of an adverse event happening was prioritized by bridge condition (poor or serious), how long the bridge is expected to stay in that condition before dropping to a lower condition, scour criticality, and load posting. The resulting risk assessment chart is shown in Figure 12. Likelihood is a measure of vulnerability and it is shown on the y-axis. Impact is a measure of the importance of the structure to the community and it is shown on the x-axis. As you move from bottom to top and left to right the higher risk.

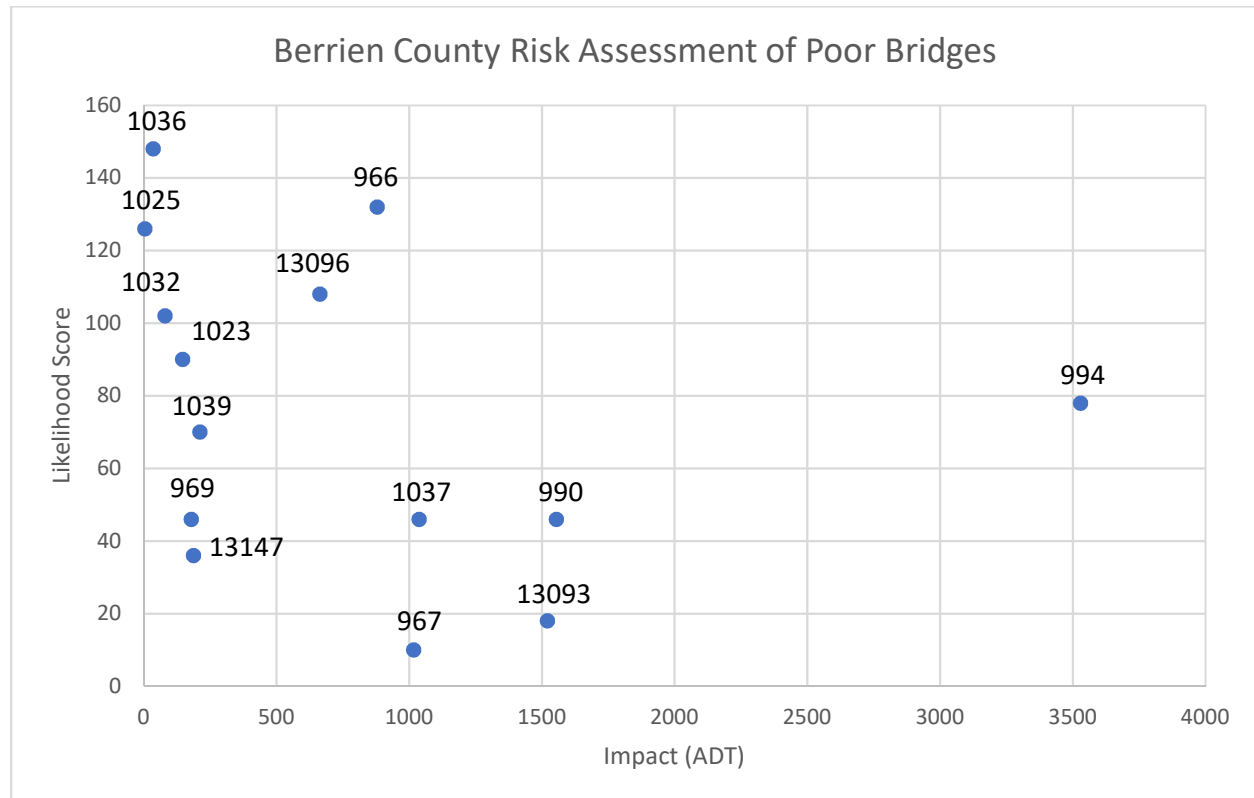


Figure 12 – Berrien County Road Department Risk Assessment of Poor Bridges.

PRESERVATION STRATEGY

The BCRD has developed a bridge asset management plan that meets their goals and objectives. This plan employs a “mix of fixes” strategy made up of replacement, rehabilitation, preventive maintenance, and scheduled maintenance. The aim of this plan is to prioritize rehabilitation and replacement projects to improve poor or worse condition bridges and NBI length culverts using a risk-based methodology. Bridges and NBI length culverts in fair condition will be prioritized for preservation using a remaining service life methodology to target bridges before they drop into poor condition.

Replacement involves substantial changes to the existing structure, such as bridge deck replacement, superstructure replacement, or complete structure replacement, and is intended to improve poor, serious, or critical bridges to a good condition rating.

Rehabilitation involves major work required to restore the structural integrity of a bridge, as well as work necessary to correct major safety defects. It is most often undertaken to improve bridge major components in poor condition to good or fair condition.

Scour mitigation involves armoring or protecting at risk foundations from scour during flood events. If a scour critical bridge cannot be reasonably mitigated it should be prioritized for replacement.

Preventive maintenance activities are performed on bridge components or elements in response to known defects. It improves the condition of that portion of the element but may or may not result in an increase in the component condition rating. It is most often undertaken to extend the service life of fair bridges. Routine preventive work will be performed by the agency's in-house maintenance crews while larger, more complex work will be contracted.

The replacement, rehabilitation, and preventive maintenance projects are generally eligible for funding under the local bridge program, and request for funding will be submitted with annual applications.

The BCRD's scheduled maintenance program is an integral part of the preservation plan and is intended to extend the service life of fair and good structures by preserving these bridges in their current condition longer. Scheduled maintenance is proactive and not necessarily condition driven. In-house maintenance crews will perform much of this work.

The BCRD uses The Kercher Group's Bridge Forecaster® tool to predict when bridges will deteriorate to the next lower condition rating in each of the program years, and manage bridge specific preventive maintenance, rehabilitation, and replacement projects in each of those years to work towards their bridge condition goals and objectives.

Project Prioritization Criteria

Rehabilitation and Replacement Program

A primary objective of the BCRD's rehabilitation and replacement program is to use the risk assessment and knowledge of local needs to select bridge and NBI length culvert projects that will move the BCRD towards their agency goals while reducing risk. In an initial five-year plan, the BCRD will prioritize selection of bridges and NBI length culverts as follows:

1. Bridges carrying evacuation routes for the nuclear plants.
2. Primary routes.
3. County local routes.
4. County subdivision.
 - a. If a subdivision bridge or NBI length culvert is the only access to the subdivision the bridge will have greater priority than one where there is multiple access to the subdivision.

Preservation Program

A preservation plan will be undertaken each year targeting bridges and NBI length culverts that are rated fair (NBI GCR 5) with the shortest estimated time to get to poor condition as shown in The Kercher Group Bridge Forecaster® tool. The BCRD will also do preservation on bridges and NBI length culverts when the work can be coordinated with other activities in the area to save money for traffic control.

IMPLEMENTATION OF THE STRATEGY

The BCRD's implementation of the preservation plan strategy begins with an annual review of the current condition of each of the agency's bridges using the NBI GCR and element inspection data collected during bridge safety and condition assessment inspections. BCRD also collects and reviews inspector's work recommendations contained on the inspection report. Preventive maintenance, rehabilitation, and replacement projects are input into The Kercher Group Bridge Forecaster® tool and cost and benefit for each project is estimated. Bridge Forecaster® predicts the condition of all BCRD bridges each year and provides column charts showing number of bridges in each NBI GCR and percent good and fair bridges as shown in Figures 13 and 14 respectively. The BCRD will review to see if progress is being made towards their goals and objectives and adjust the program accordingly. The forecasts, as demonstrated in Figures 13 and 14, will be updated annually as the program evolves.

Preservation actions are selected in accordance with criteria contained in Appendix A. These criteria are based on MDOT's Project Scoping Manual, which is intended to address MDOT's trunk line bridges.

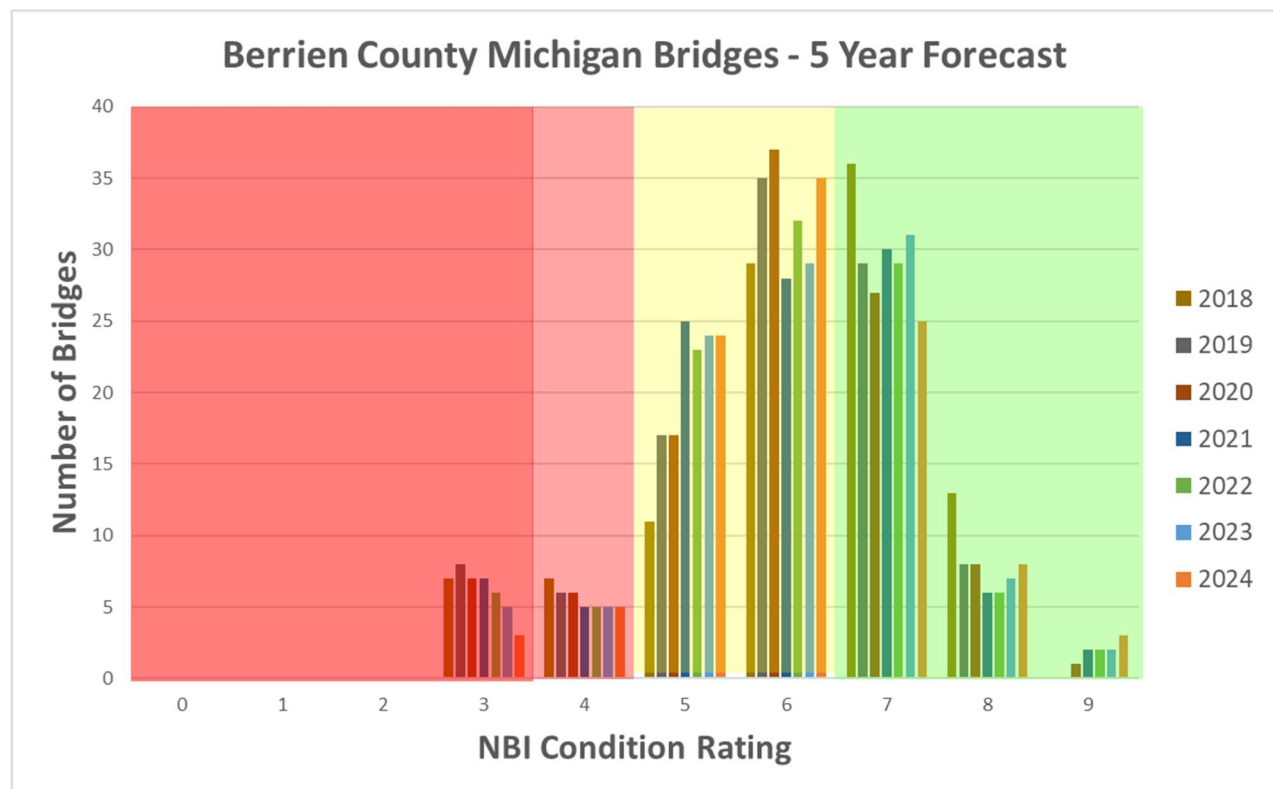


Figure 13 – Berrien County Road Department Bridges and NBI Length Culverts – 10 Year Forecast

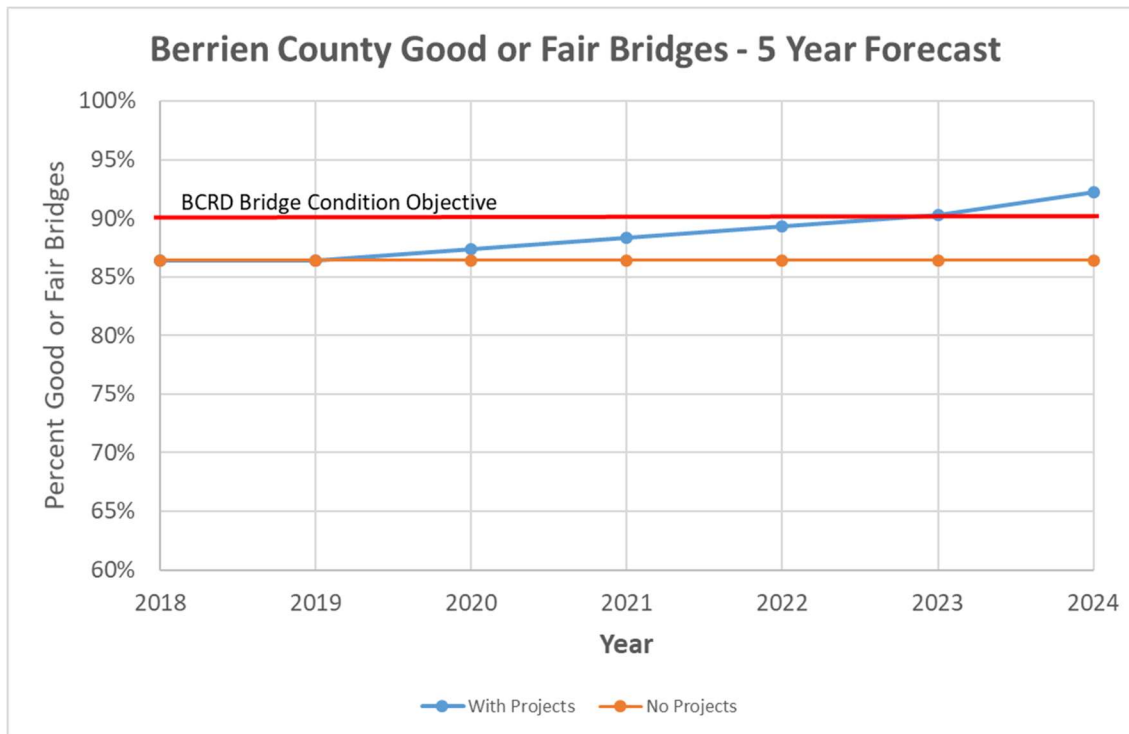


Figure 14 – Berrien County Road Department Good or Fair Bridges – 5 Year Forecast

BCRD also looks for efficiencies in their program by coordinating pavement, bridge, and other work activities. This is aided by mapping their good, fair, and poor bridges in an interactive Google map as shown Figure 15.

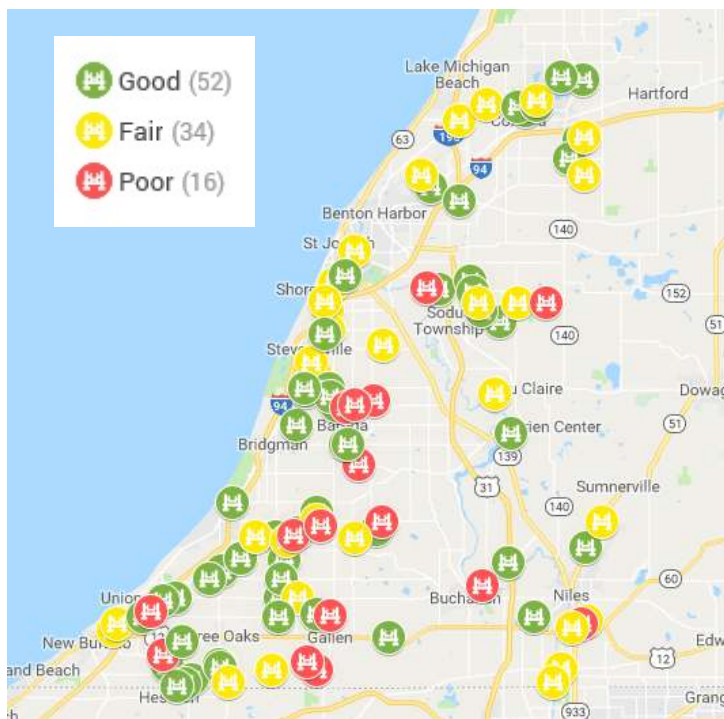


Figure 15 – Google map of BCRD Good, Fair, and Poor Bridges.

Cost Estimates

The BCRD computes the estimated cost of each typical preservation action using unit prices in the latest Bridge Repair Cost Estimate spreadsheet contained in MDOT's Local Bridge Program Call for Projects. The cost of items of varying complexity, such as maintenance of traffic, staged construction, scour counter-measures, and so forth, are computed on a bridge-by-bridge basis. The cost estimates are reviewed and updated annually, and as more detailed project information becomes available. For replacement projects, the BCRD also uses the Fiscal Year 2018 Local Agency Bridge Projects Average Cost shown in Appendix B.

Five-Year Annual Cost Projection

The Berrien County Road Department five-year annual cost projection is as follows in Table 2.

Year	Rehabilitation and Replacement	Preservation	Total Bridge Budget
2019	\$760,000	\$43,000	\$803,000
2020	\$800,000	\$48,000	\$848,000
2021	\$1,500,000	\$1,540,000	\$3,040,000
2022	\$650,000	\$200,000	\$850,000
2023	\$500,000	\$200,000	\$700,000

Table 2 – BCRD Five-year Annual cost Projection

This program includes five replacement projects, two rehabilitation projects, and ten preventive maintenance projects. Additional capital scheduled maintenance projects will be programmed as budget and resources allow. This information is subject to change as budget is made available and projects are scoped, designed, and programmed.

Identify Funding Sources

The BCRD bridge asset management plan will be implemented by identify funding sources such as,

- Local agency bridge funding through the Michigan Local Agency Bridge Program.
- Dedicated BCRD funding and resources.
- Grants and other funding opportunities.

Operations and Maintenance Plan—Annual Activities/5-Year Program

For operations and maintenance activities, BCRD produces and maintains a list of preservation needs each year using inspector recommendations and County Highway Engineer observation of needs. The 2018 list follows in Table 3.

Structure Number - Location	Preservation Recommendations
SN 977 - Coloma Road over Paw Paw River	Healer/sealer until deck replacement
SN 980 - Red Arrow over Galien River	Healer/ sealer and map cracking
SN 998 - Paw Paw Lake Road over Paw Paw River	Centerline joint seal needs to be resealed and seal cracks
SN 13193 - Sodus Parkway over Pipestone Creek	Seal cracks in deck
SN 13095 - Linco Road over Keelo Creek	Seal cracks in deck
SN 13094 - Jericho Road over Keelo Creek	Reseal reference line joints and healer/sealer and seal cracks

Berrien County Michigan**Asset Management Plan for County-Maintained Bridges**

SN 13092 - Paw Paw Lake Road over Derby Drain	Patch spalls in culvert
SN 1000 - Washington Avenue over Hickory Creek	Seal cracks in deck and place epoxy overlay on deck
SN 999 – N. Watervliet Road over Paw Paw Lake Outlet	Seal cracks in deck
SN 996 - Red Arrow Hwy over Blue Creek	Seal cracks in deck and reseal E3 joints with hot poured rubber
SN 995 - Third Street over Brandywine Creek	Sheet piling replacement
SN 993 - Hillandale Road over Pipestone Creek	Mill and overlay with water proofing membrane
SN 991 - Dayton Road over Amtrak	Mill and overlay with water proofing membrane
SN 989 - Cleveland Avenue over Hickory Creek	Healer/sealer and seal fascia beams and seal cracks in concrete pile cover and patch spalls in abutment
SN 986 - Mill Road over Galien River	Seal cracks in deck and patch spall in approach slab
SN 985 - Three Oaks Road over Galien River	seal cracks in deck or place epoxy overlay and repair seal in SE quad
SN 984 - Three Oaks Road over Chamberlain Drain	Seal fascia beams and railings
SN 981 - Lakeside Road over Galien River	Repair corroded sheet pile and patch spalled areas at end of fascia beams
SN 979 - Red Arrow Hwy over Amtrak	Epoxy overlay and seal railings and beams and patch spall in west fascia beam
SN 978 - Carmody Road over Mill Creek	Healer/sealer and seal cracks in concrete parapet
SN 976 - Territorial Avenue over Blue Creek	Seal cracks in deck and brace sheet pile wall in SW quad

Table 3 – BCRD County Highway Engineer Preservation Recommendations.

APPENDIX A – SUMMARY OF PRESERVATION CRITERIA

Summary of Preservation Criteria from MDOT Project Scoping Manual		
Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	<ul style="list-style-type: none"> - NBI Rating of 3 or less - OR when cost of rehabilitation exceeds cost of replacement - OR when bridge is scour critical with no counter-measures available 	70 years
Superstructure Replacement	<ul style="list-style-type: none"> - NBI Rating for superstructure of 4 or less - OR when cost of rehabilitating superstructure and deck exceeds replacement cost 	40 years
Deck Replacement <ul style="list-style-type: none"> • Epoxy Coated Steel • Black Steel 	Use guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i> <ul style="list-style-type: none"> - NBI Rating of 4 or for deck surface and deck bottom - OR when deck replacement cost is competitive with rehabilitation 	70 years 40 years
Substructure Replacement (Full or Partial)	<ul style="list-style-type: none"> - NBI Rating of 4 or less for abutments, piers, or pier cap - OR existence of open vertical cracks, signs of differential settlement, or presence of active movement - OR bridge is scour critical with no counter-measures available 	40 years
Rehabilitation		
Concrete Deck Overlays <ul style="list-style-type: none"> • Deep • Shallow • HMA/Membrane • HMA Cap 	Guidelines in MDOT's <i>Bridge Deck Preservation Matrix</i> <ul style="list-style-type: none"> NBI Deck Rating <5 for surface and >5 for bottom NBI Deck Rating <5 for surface and >4 for bottom NBI Deck Rating <5 for surface and >4 for bottom NBI Deck Rating <5 for surface and <4 for bottom 	25 years 12 years 8 years 3 years
Railing Retrofit/Replacement	<ul style="list-style-type: none"> - NBI Deck Rating greater than 5 - OR Railing/Barrier rated less than 5 - OR Safety Improvement is needed 	
Steel Beam Repairs	<ul style="list-style-type: none"> - More than 25% section loss is present in an area of the beam that affects load carrying capacity - OR in order to correct impact damage that impairs beam strength 	
Prestressed Concrete Beam Repairs	<ul style="list-style-type: none"> - Repair ends of prestressed I-beams when more than 5% spalling is present - OR repair areas to correct impact damage that impairs beam strength or exposes prestressing strands 	
Repair/Replace Culvert	<ul style="list-style-type: none"> - NBI Rating of 4 or less for culvert or drainage outlet structure - OR existence of open vertical cracks, signs of deformation, movement, or differential settlement 	
Repair/Replace Retaining Wall	<ul style="list-style-type: none"> - NBI Rating of 4 or less for retaining wall - OR existence of open vertical cracks, signs of differential settlement, or presence of active movement 	

Berrien County Michigan

Asset Management Plan for County-Maintained Bridges

Pin and Hanger Replacement	- NBI Rating for elements is 4 or lower; presence of excessive section loss, severe pack rust, or out-of-plane distortion	
Substructure Concrete Patching and Repair	- NBI Rating for abutments or piers is 5 or 4 and less than 30% of the surface is spalled and delaminated - OR in response to inspector's work recommendation for substructure patching	
Preventive Maintenance		
Repair/Replace Deck Joint	- Include when doing deep or shallow overlays - OR NBI Rating for joint is 4 or lower - OR joint is leaking heavily	
Repair/Replace Steel Bearing	- NBI Rating for girders and deck is 5 or higher and rating for bearings is 4 or lower	
Complete Painting	- NBI Rating for paint condition is 3 or lower - OR in response to inspector's work recommendation for complete painting	15 years
Zone Painting	- NBI Rating for paint condition is 5 or 4 - OR less than 15% of existing paint area has failed and remainder of paint system is in good or fair condition	10 years
HMA Overlay Cap without Membrane	- NBI Rating of 3 or less for deck surface and deck bottom; temporary holdover to improve ride quality for a bridge in the 5-year plan for rehab/replacement	3 years
Concrete Deck Patching	- Deck Surface Rating of 5, 6, or 7 with minor delamination and spalling - OR in response to inspector's work recommendation	5 years
Channel Improvements	- Removal of vegetation, debris, or sediment from channel and banks to improve channel flow - OR in response to inspector's work recommendation	
Scour Countermeasures	- Structure is categorized as scour critical and is not scheduled for replacement; NBI comments in abutment and pier ratings indicate presence of scour holes	
Scheduled Maintenance		
Superstructure Washing	- When salt contaminated dirt and debris collected on superstructure is causing corrosion or deterioration by trapping moisture - OR in response to inspector's work recommendation	2 years
Vegetation Control	- When vegetation traps moisture on structural elements or is growing from joints or cracks - OR in response to inspector's work recommendation for brush cut	1 year
Debris Removal	- When vegetation, debris, or sediment accumulates on the structure or in the channel - OR in response to inspectors work recommendation	1 year
Drainage System Clean-Out/Repair	- When drainage system is clogged with debris or drainage elements are broken, deteriorated, or damaged	2 years
Spot Painting	For zinc-based paint systems only	5 years

Berrien County Michigan**Asset Management Plan for County-Maintained Bridges**

	- In response to inspector's work recommendation	
Seal Concrete Cracks/Joints	- Concrete is in good or fair condition, and cracks extend to the depth of the reinforcement - <i>OR</i> in response to inspector's work recommendation	5 years
Repair/Replace HMA Surface	- HMA surface is in poor condition - <i>OR</i> in response to inspector's work recommendation	
Seal HMA Cracks/Joints	- HMA surface is in good or fair condition, and cracks extend to the surface of the underlying slab or sub course - <i>OR</i> in response to inspector's work recommendation	
Minor Concrete Patching	- Repair minor delaminations and spalling - <i>OR</i> in response to inspector's work recommendation	
Timber Repairs	- NBI Rating of 4 or less for timber members - <i>OR</i> to repair extensive rot, checking, or insect infestation	
Repair/Replace Guard Rail	- Guard rail missing or damaged - <i>OR</i> safety improvement is needed	
Repave Approaches	- HMA is in poor condition - <i>OR</i> in response to inspector's work recommendation	
Repair Slopes	- NBI Rating is 5 or lower - <i>OR</i> when slope is degraded or sloughed - <i>OR</i> slope paving has significant areas of distress, failure, or has settled	
Install Riprap	To protect surface when erosion threatens the stability of side slopes of channel banks	
Miscellaneous Repairs	Uncategorized repairs in response to inspector's work recommendation	

APPENDIX B – FISCAL YEAR 2018 LOCAL AGENCY BRIDGE PROJECTS AVERAGE COST

Fiscal Year 2018 Let Projects' Approach and Cost per Square Foot									
County or City	Region	Road Name	Crossing	Job Number	Low Bid Cost	Proposed Deck Width	Proposed Deck Length	Proposed Approach Costs	Cost (\$/sft) (w/o approach)
Clinton County	University	Grove Road	Stony Creek	123157A	\$852,888	31.6	66.0	\$208,616	\$209,278
Isabella County	Bay	Isabella Road	Little Salt River	129277A	\$575,715	34.3	52.0	\$174,615	\$223
Saginaw County	Bay	Steel Road	Bad River	129561A	\$593,700	33.5	50.0	\$167,015	\$203,115
Mecosta County	Grand	20th Ave	Chippewa River	129305A	\$742,412	28.5	76.0	\$167,789	\$265
Manistee County	North	Coates Highway	Big Manistee River	118592A	\$1,491,541	34.3	212.0	\$284,353	\$166
City of Marshall	Southwest	Marshall Ave.	Kalamazoo River	126749A	\$1,329,239	53.0	94.8	\$432,000	\$169
Mackinac County	Superior	Hill Island Road	Flower Bay, Lake Huron	126654A	\$1,086,267	41.3	48.0	\$198,010	\$300
Manistee County	Superior	NP Road	Canp River	129351A	\$766,395	44.3	43.8	\$198,010	\$300
Washtenaw County	University	Sharon Valley Road	River Raisin	129378	\$1,512,240	43.6	70.0	\$353,810	\$268
Isabella County	Bay	Meridian Road	N. Br. Chippewa River	129393A	\$778,868	39.5	60.0	\$239,460	\$228
Marquette County	Superior	County Road 557	Big West River	129353A	\$1,097,714	40.0	70.0	\$280,010	\$284
Branch County	Southwest	Lindley Rd.	Little Swan Creek	126666A	\$573,202	31.4	58.0	\$128,401	\$244
Ionia County	Grand	Hastings Road	Duck Creek	129306A	\$993,913	41.2	47.2	\$193,010	\$346
Mason County	North	Darr Road	NB Lincoln River	129322A	\$423,912	19.2	46.0	\$81,610	\$239
Mason County	North	Darr Road	SB Lincoln River	129323A	\$409,550	29.2	36.0	\$178,731	\$220
City of Southfield	Metro	Nine Mile Road	E vans Br Rogue River	126874A	\$4,370,087	63.0	124.0	\$2,383,333	\$254
Calhoun County	Southwest	28 1/2 Mile Road	S. Br. Kalamazoo River	129339A	\$572,095	60.0	31.7	\$192,010	\$183
Calhoun County	Southwest	21 Mile Road	Rice Creek	129337A	\$597,807	60.0	31.7	\$192,010	\$197
Berrien County	Southwest	Nyre Road	Dowling Creek	126669A	\$576,849	37.8	24.0	\$98,210	\$192
St. Clair County	Metro	Goodells Road	Moore Creek	129314A	\$542,229	45.0	35.2	\$193,582	\$467
Allegan County	Southwest	56th Street	Black River	129336A	\$1,026,538	42.9	50.0	\$214,510	\$220
Oakland County	Metro	Opdyke Road	Clinton River	12746A	\$2,711,032	84.3	62.0	\$223,510	\$519
Sanilac County	Bay	Malvin Road	McDonald Drain	129264A	\$613,853	33.4	50.0	\$174,619	\$253
Oscoda County	North	Park Road	E. Br. Big Creek	129321A	\$683,322	38.0	50.0	\$190,010	\$277
Genesee County	Bay	Bristol Road	Gall Drain	129294A	\$1,794,554	18.0	132.0	\$913,467	\$371
Newaygo County	Grand	Colonial Road	Marquette Railroad	126594A	\$1,674,032	35.3	124.0	\$658,177	\$232
Calhoun County	Southwest	25 1/2 Mile Road	Kalamazoo River	126673A	\$1,026,591	35.5	111.7	\$217,631	\$204
St. Clair County	Metro	Fifth Road	Holland Drain	129309A	\$729,282	49.5	24.3	\$321,421	\$340
Oakland County	Metro	Wixom Road	Huron River	13063A	\$1,206,260	43.3	62.0	\$473,001	\$273
Median:									\$239
Mean:									\$247

APPENDIX C – KERCHER BRIDGE FORECASTER©

The Kercher Bridge Forecaster© spreadsheet predicts the future condition of bridges for a maximum of ten years given deterioration rates shown as expected Time In Condition Rating (TICR) and an initial estimated time to condition drop, which is evaluated and entered into the spreadsheet ahead of time. The spreadsheet includes a row for each BCRD NBI bridge as shown in Column A in Figure C1. The overall General Condition Rating (GCR) for the bridge for the given year is shown in Column AV. Bridges in good condition are shaded green, bridges in fair condition are shaded yellow, and bridges in poor condition are shaded red. The arrow in Column AW indicates that the GCR dropped entering that year. Column AY shows the estimated time to condition drop for that bridge. For each year in the agency program, the user of the spreadsheet can enter a project (preventive maintenance, rehabilitation, or replacement), the project cost, and the benefit of the project for any bridge included in the analysis. Benefit for rehabilitation or replacement projects are entered as the “updated bridge rating” following the project. This is shown in Figure C1 in Column BB for the Glendora Road over E.Br. Galien River (Structure Number 966) where the bridge is expected to be rated GCR 9 following the replacement project. For a preventive maintenance project benefit is shown as adding time for the bridge to remain in its current condition rating. Figure C1 shows an example of this for the Coloma Road over Paw Paw River (Structure Number 977) where in column BC the added time in GCR 5 is 5 years. Yearly project type and cost totals are shown on Row 117 for each year of the analysis as shown in Figure C2.

A	AV	AW	AY	AZ	BA	BB	BC
Facility over Features Intersected	2019	Arrow 2019	Estimated Time to Condition Drop 2019	2019 Projects	Cost 2019	Updated Bridge Rating 2019	PM Added Time in Condition Rating 2019
FOREST LAWN ROAD over S BR GALIEN RIVER - 956	7		4				
FOREST LAWN ROAD over SPRING CREEK - 957	7	↓	12				
BERTRAND ROAD over ST JOSEPH RIVER - 958	5		9				
KRUGER ROAD over S BR OF GALIEN RIVER - 959	6	↓	15				
KRUGER ROAD over DOWLING CREEK - 960	8		1				
WARREN WOODS ROAD over GALIEN RIVER - 962	7		4				
WARREN WOODS ROAD over GALIEN RIVER - 963	7		0				
PUCKER STREET over DOWAGIAC CREEK - 964	6	↓	15				
GLENDORA ROAD over E BR GALIEN RIVER - 965	7		17				
GLENDORA ROAD over E BR GALIEN RIVER - 966	5		5	Replacement	\$760,000	9	
GLENDORA ROAD over E BR GALIEN RIVER - 967	4		19				
SNOW ROAD over HICKORY CREEK - 969	4		7				
SHAWNEE ROAD over FOWLER DRAIN - 970	7		10				
SHAWNEE ROAD over HICKORY CREEK - 971	7	↓	12				
HINCHMAN ROAD over HICKORY CREEK - 972	6	↓	15				
GLENLORD ROAD over HICKORY CREEK - 973	5	↓	19				
NAOMI ROAD over PIPESTONE CREEK - 974	6	↓	15				
NAPIER AVENUE over ST JOSEPH RIVER - 975	5		11				
TERRITORIAL ROAD over BLUE CREEK - 976	7	↓	12				
COLOMA ROAD over PAW PAW RIVER - 977	5		9	Preventive Maintenance	\$22,000		5

Figure C1 – Screenshot of the Kercher Bridge Forecaster© spreadsheet Projects and Benefits Columns.

Project Type - 2019	Number Project Types	Cost
Replacement	1	\$760,000
Rehabilitation	0	\$0
PM	4	\$43,000
Total	5	\$803,000

Figure C2 – Screenshot of the Kercher Bridge Forecaster© spreadsheet Yearly Project and Cost Totals

APPENDIX D – KERCHER BRIDGE VIEWER®

The Kercher Bridge Viewer® spreadsheet shows all major component General Condition Ratings (GCR) for a selected bridge in table form and as a line chart as demonstrated in Figure D1. The user simply selects the bridge in Cell "I9" and Visual Basic for Applications coded finds the condition ratings for the bridge. This can be used to see deterioration trends and find when a bridge may have been rehabilitated or replaced.



Figure D1 – Kercher Bridge Viewer® spreadsheet.

APPENDIX E – BCRD GOOGLE MAP OF GOOD, FAIR, AND POOR BRIDGES

A Google Map of BCRD's good, fair, and poor bridges can be seen at the following link.

<https://drive.google.com/a/kerchergroup.com/open?id=1m-4F20XCOSU4Q7Mp8houXQc9c12pX8M&usp=sharing>

The map can be used for strategic planning and coordinating pavement, bridge, and other projects.



Figure E1 – Google Map of BCRD Good, Fair, and Poor Bridges.



MICHIGAN CHAPTER



NOMINATION FORM | 2019 APWA MICHIGAN CHAPTER PUBLIC WORKS PROJECT OF THE YEAR AWARD

Purpose - The APWA Michigan Chapter Public Works Project of the Year Award was established to promote excellence in the management and administration of public works projects by recognizing the alliance between the managing agency, the consultant/architect/engineer, and the contractor who, working together, complete public works projects.

Eligibility - Public works is defined as the physical structures and facilities that are developed, owned, and maintained by public agencies to house governmental functions and provide water, power, waste disposal, transportation, and similar public services in accordance with established public policy.

To be eligible for nomination, a project must have been "substantially completed" and available for public and/or agency use within two calendar years prior to nomination. If a project has multiple phases or segments, then "substantially completed" will be construed as that point when the final phase or segment is 90% completed and available for public and/or agency use.

A project may only be nominated once for recognition as "Project of the Year" under any category. Contact Karen Mondora, PE, APWA Michigan Chapter Awards Chairperson, with questions at kmondora@fhgov.com or (248) 871-2530.

DEADLINE January 18, 2019

(electronic submittals only at <https://dbinbox.com/michiganapwa>)

PROJECT NAME

2018 TAMC Michigan Local Agency Culvert Inventory Pilot

PROJECT COMPLETION DATE

Must be substantially completed (90%) and available for public use as of December 31, 2018

September 30, 2018

PUBLIC AGENCY

Transportation Asset Management Council

PROJECT CATEGORY (Choose 1)

- ☐ Disaster or Emergency Construction/Repair
- ☐ Environment
- ☐ Historical Restoration/Preservation
- ☐ Quality of Life
- ☐ Structures
- ☐ Transportation

PROJECT DIVISION

- ☐ Less than \$1 Million
- ☐ \$1 Million to \$5 Million
- ☐ \$5 Million to \$25 Million
- ☐ \$25 Million to \$75 Million

SPECIAL PROJECT CATEGORY

- ☒ Governmental Cooperation
(No Cost Divisions. Capital Projects are not eligible)

MANAGING AGENCY

Roger Belknap / Rebecca Curtis, PE

Name

MDOT TAMC Coordinator / MDOT Deputy Chief Bridge Engineer

Title

Michigan Department of Transportation

Agency/Organization

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PRIMARY CONTRACTOR

Name

Title

Agency/Organization

Address (if post office box, include street address)

City

State/Province

Zip/Postal Code

Phone

Fax

Email



NOMINATION FORM | 2019 APWA MICHIGAN CHAPTER PUBLIC WORKS PROJECT OF THE YEAR AWARD

PRIMARY CONSULTANT

Tim Colling, PE / Scott Bershing / Chris Gilbertson, PE

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NOMINATED BY: (Can only be nominated by managing public agency or APWA Michigan Chapter branches) Projects that involve or reside within two or more branch locations can be co-nominated.

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Agency/Organization

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Please address each of the following areas in your nomination, adhering to the sequence below when possible.

1. Construction schedule, management, and control techniques used. Completion date contained in contract. Any time extensions granted should be addressed in the submittal.
2. Safety performance including number of lost-time injuries per 1,000 man-hours worked and overall safety program employed during the construction phase.
3. Community relations - a summary of the efforts by the agency, consultant and contractor to protect public lives and property, minimize public inconvenience and improve relations.
4. Environmental considerations including special steps taken to preserve and protect the environment, endangered species, etc., during the construction phase.
5. Unusual accomplishments under adverse conditions, including but not limited to, adverse weather, soil or site conditions, or other occurrences over which there was no control.
6. Additional considerations you would like to bring to the attention of the project review panel, such as innovations in technology and/or management applications during the project.
7. Use of alternative materials, funding practices, or sustainable infrastructure rating system (such as the Envision rating system) to ensure project is sustainable.

NOTE: Supporting documentation is **limited to 20 pages**, exclusive of photographs and nomination form and shall be in pdf format. Photographs will be used for promotional purposes by the association and should be submitted as a .jpeg, .bmp, or .gif. Submittal should include nomination form and supporting documentation form, and photographs. No letters of recommendation please.

Disaster or Emergency Construction/Repair - to include techniques and timing for safety, community relations, environmental protection, adverse conditions and additional considerations.

Environment - to include treatment and recycling facilities, landfill reclamation projects, sewer projects, etc.

Governmental Cooperation - to include multiple community ventures or cost sharing means. (No cost divisions for this category. Capital projects are not eligible.)

Historical Restoration/Preservation - to include historical restoration, preservation and adaptive reuse of existing buildings, structures, and facilities, etc.

Quality of Life - to include parks, monuments, community planning, urban renewal and streetscape.

Structures - to include public structure preservation/rehabilitation, municipal buildings, parks, etc.

Transportation - to include roads, bridges, mass transit, etc.

2019 APWA Michigan Chapter – Public Works Project of the Year Award

Nominated Project: 2018 Michigan Transportation Asset Management Council (TAMC)

Michigan Local Agency Culvert Inventory Pilot

Special Project Category: Governmental Cooperation

PROJECT OVERVIEW

In 2018, the TAMC tasked its Bridge Committee with managing a work plan for a pilot project for the collection of data and the evaluation of culverts owned by local transportation agencies within Michigan. The work was funded through House Bill 4320 (S-3) - Supplemental Appropriation Adjustments, which added \$2 million to the fiscal year 2018 budget from the state restricted Michigan Infrastructure Fund.

Based on recommendations made in the 21st Century Infrastructure Commission Report, the TAMC decided to use the funding for a pilot project to assist local transportation agencies with the collection of culvert data on their local road network. A full report of the project's findings was due by the end of fiscal year 2018 (September 30, 2018) as a condition of the funding from the Legislature. Therefore, training and data collection tasks had to be expedited in order to develop the project's findings with adequate time to process and analyze the data that was collected. Given the relatively short timeframe, and the scope and logistics of the pilot project, the TAMC reached out to the Center for Technology & Training (CTT) at Michigan Technological University to assist with managing and facilitating the project. The CTT and the TAMC have a long-standing working relationship that, combined with the working structure that the TAMC had already established with local transportation agencies through previous projects, allowed the CTT and the TAMC to quickly initiate, launch, and complete the culvert data collection pilot project within the required timeline.

Project Goals

The intent of the culvert data collection pilot project was to collect data on Public Act 51 Certified Roads in Michigan at a statewide level for the following goals:

1. Estimate the total number of culverts in the state.
2. Estimate the overall condition of culverts in the state using similar inspection components and rating.
3. Determine the range of physical characteristics (inventory information) of culverts, such as material, size, and depth, that may impact the cost to maintain or replace the asset.
4. Benchmark estimates of agency labor (time and materials) necessary to find and collect inventory data for culverts on a dollar per mile or other production rate basis.
5. Benchmark estimates of agency labor (time and materials) necessary to find and collect condition data for culverts on a dollar per mile or other production rate basis.

Project Report

A final report of the pilot project was provided to the Michigan Legislature, Governor Rick Snyder and the Michigan Infrastructure Council on October 1, 2018. The report included

background, methods, observations and recommendations for continuing the effort to collect, assess and manage culvert data into the future.

PROJECT SCHEDULE, MANAGEMENT, AND CONTROL TECHNIQUES

Project Schedule

There were ten tasks associated with the deployment of the culvert data collection pilot project. With constraints associated with contractual obligations of the funding source and the September 30, 2018 deadline for the final report, the schedule of activities for this pilot effort covered only 7.5 months (32 weeks). The activities and timeframes are identified as follows:

Literature Review of Best Practices	February 19 – March 26
Local Agency Survey (Data Availability & Extent)	March 5 – March 16
Selection of Data Collection & Storage Methods	March 19 – March 23
Develop & Conduct Pilot Training	March 26 – May 4
Selection of Participating Agencies	March 26 – March 30
Pilot Data Collection (Field Work)	April 30 – July 30
Pilot Centralized Data Storage Solution	June 4 – August 31
Evaluation of Pilot	August 6 – September 14
State-wide Collection Cost Estimate	August 6 – September 21
Final Report	August 6 – September 30

Project Management

The FY2018 State of Michigan budget provided for \$2,000,000 from the state restricted Michigan Infrastructure Fund to the Transportation Asset Management Council to inspect and inventory culverts on the local road system. The source of funds was House Bill 4320 (S-3) - Supplemental Appropriation Adjustments. The responsibility for administering the funds was with the Michigan Department of Transportation, which included Finance, Contract Services and the Asset Management and Policy Division of the Bureau of Transportation Planning. The responsibility for developing a project budget and work plan was given to the TAMC Bridge Committee, which is a standing sub-committee of the TAMC.

Project Consultant

TAMC reached out to the Center for Technology and Training (CTT) at Michigan Technological University to assist with managing and facilitating the project. The CTT and the TAMC have a long-standing working relationship that, combined with the working structure that the TAMC has already established with the local transportation agencies through previous projects, allowed the CTT and the TAMC to quickly initiate, launch, and complete the culvert data collection pilot project within the required timeline.

Based on the budget established by the TAMC Bridge Committee, the CTT assembled a work program to guide the project from information gathering to final reporting. Drawing from information gathered during the literature review, CTT staff developed recommendations for data collection procedures, data elements to collect, equipment recommendations for field

data collection, assessment methods for evaluating the condition of culverts, and the necessary field log forms for tracking the effort needed to complete the work. The CTT then established a training program for guidance on the data collection operation. Upon completion of the data collection effort, the CTT then reviewed and analyzed the data that was collected. The CTT provided the TAMC with a full report of the project, complete with findings and recommendations for future culvert data collection efforts.

Michigan's Regional Metropolitan Planning agencies played a role as administrators of the reimbursement process. TAMC, using MDOT's Contract Services Division and the Bureau of Planning's Unified Work Program procedures, partnered with all fourteen of Michigan's Regional Planning Agencies (RPA) and the two Metropolitan Planning Organizations (MPO) that represent the Kalamazoo and Grand Rapids urban areas. The TAMC adopted a reimbursement policy for the local agency participants and leveraged the existing data collection procedures including standardized invoicing and activity reports submitted to MDOT through the RPA and MPO contracts. Staff from several RPAs and MPOs also participated in training and performed some field data collection on behalf of local agencies as well.

Another important aspect of the project consulting effort was the coordination of the data submittal process and data storage with the Michigan Department of Technology, Management and Budget (DTMB) Center for Shared Solutions (CSS). The CSS provides database administration and technical development support to the TAMC. The CSS also participated in the Governor's 21st Century Regional Asset Management Pilot in 2017 and was prepared to receive the collected data to support a statewide integrated system. The CTT worked closely with the CSS to build additional Roadsoft functionality to enable users to upload the data directly to the CSS. They also worked together to allow the five agencies not using Roadsoft to submit data.

Project Planning

All local transportation agencies in the state were invited to participate in the Michigan Local Agency Culvert Inventory Survey offered between March 5-16, 2018. The goal of the survey was to assist the TAMC Bridge Committee with the completion of the project work plan, the selection of participating agencies, and the identification of appropriate culvert data to collect. All agencies that responded to the survey were eligible to participate in the culvert pilot. Based on the survey responses, agencies that were willing to participate in the pilot were divided into tiers according to their existing level of culvert inventory and "rounds" based on their tier and geographical proximity to other responding agencies.

Given the fixed budget, the unknown number of culverts that agencies would be collecting data on, and an unknown number of participating agencies, the TAMC Bridge Committee discussed several funding options and scenarios to distribute the funding equitably. It was determined that all participating agencies were to receive a fixed mobilization reimbursement for training, purchasing of equipment to be used on the pilot, and for other pilot-related activities. County

road agencies received \$10,000, and city/village road agencies received \$5,000. In addition, all local agencies were to receive \$30/per-centerline-mile where they drove to collect culvert data, not to exceed the agency's Public Act 51 certified total centerline-miles.

It was determined that local transportation agencies would collect data on culverts ranging from 1 to <20-foot span, as culverts that span 20 feet and larger should already be included in local agencies' bridge inventory. The TAMC Bridge Committee established a list of culvert attributes to be collected as part of the pilot, as well as six condition evaluation criteria.

Training

The CTT hosted an informational webinar on April 19, 2018 to outline the pilot project and solicit questions and feedback from potential participating agencies. The CTT then hosted training webinars on April 25 and 26, 2018 to go over culvert inventory data collection using the Roadsoft Laptop Data Collector (LDC), and culvert condition evaluation, respectively. Lastly, the CTT hosted a webinar on July 24, 2018 to instruct participating agencies on how to submit their culvert data. Roadsoft is a roadway asset management system for collecting, storing, and analyzing data associated with transportation infrastructure. The MDOT provides Roadsoft to local agencies at no cost as part of the statewide roadway asset management initiative spearheaded and supported by MDOT. Webinars were chosen as the most practical and cost-effective means to provide training to the participants due to the time constraints of the data collection season and the broad participation from all regions across the state.

PROJECT OUTCOMES

Data Collection and Results

CTT staff visited nine agencies to observe their culvert data collection processes. Generally, all the agencies visited had similar processes for data collection that varied slightly based on the tools they used.

Once the agency culvert data was submitted to the CSS, the CTT compiled and processed the information to provide answers for the five key goals of the culvert pilot project. Results are as follows:

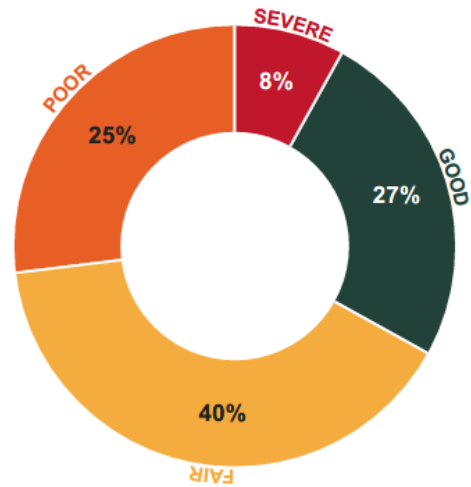
- 1. Estimate the total number of culverts in the state*

After compiling the submitted culvert data and the data from daily data collection logs, the CTT calculated the estimated number of statewide local agency culverts to be between 178,939 and 213,649. The range is due to estimates or calculations using six different data subdivisions. The average of this range is 196,294 statewide local agency culverts.

2. *Estimate the overall condition of culverts in the state using similar inspection components and rating*

Based on the submitted data, overall condition assessments indicate that a majority of the culverts inspected were in fair to good condition with 27.0% of the rated culverts holding condition ratings of 8 (good) or better, and 67.2% of the rated culverts holding conditions ratings of 6 (fair) or better. The condition rating scale for this pilot project ranged from 1 (failed) to 10 (new). Of the inventoried culverts, 69.2% included a condition rating. Of the culverts inventoried during the pilot, 78.0% had ratings collected in 2018, and 92.0% were rated in the last five years.

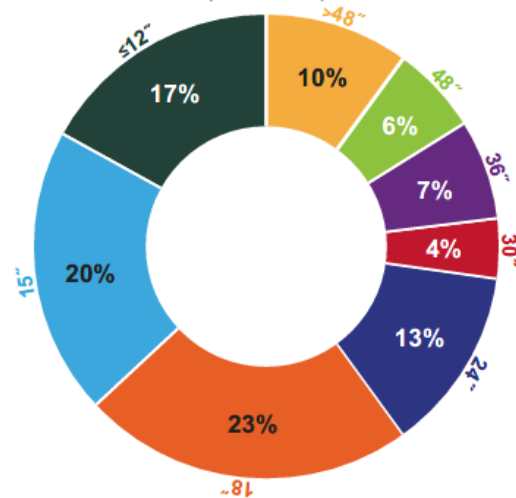
Estimated Local Agency Culvert Condition



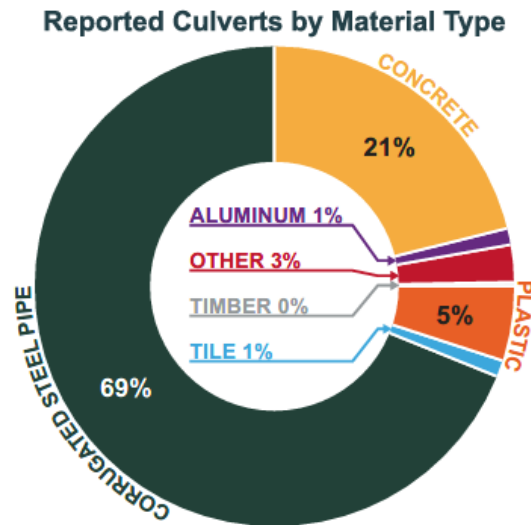
3. *Determine the range of physical characteristics (inventory information) of culverts, such as material, size, and depth, that may impact the cost to maintain or replace the asset*

Of the inventoried culverts, 69% were corrugated steel pipe, 21% were concrete, and 5% were plastic. The vast majority of reported culverts—88%—were circular. Of the reported circular culverts, 90% were 48 inches or less in span, 36% have 24 inches or less of cover, and 49% have between 25-72 inches of cover. The most frequent road surface type was asphalt pavement at 66%, followed by gravel at 28%. The road surface type provides important information that can be used for the estimation of replacement costs, since restoration is a significant expense.

Reported Culverts by Span or Diameter (in inches)



The total volume of culverts on the locally-owned road system represents a significant asset. Local agencies own an estimated 7.3 to 9.2 million feet (1,389 to 1,756 miles) of culvert. As a basis for comparison, this is enough culvert pipe to build a single straight culvert from Houghton, Michigan to Miami, Florida! It is estimated that the total replacement value of locally-owned culverts in Michigan exceeds \$1.48 billion.



4. *Benchmark estimates of agency labor (time and materials) necessary to find and collect inventory data for culverts on a dollar per mile or other production rate basis*

Estimating the expected costs to find and collect inventory data for culverts is difficult due to variables such as labor rates, culvert density, and culvert cover. Based on assumed crew size; pay; and benefit and overhead rates; the average culvert data collection labor cost is estimated to be \$39.02 per mile for county road agencies and \$69.17 per mile for cities and villages.

5. *Benchmark estimates of agency labor (time and materials) necessary to find and collect condition data for culverts on a dollar-per-mile or other production rate basis*

The daily data collection logs did not contain a large enough data set to directly determine the time needed to collect condition rating information on known culverts. However, the daily logs show the average time per culvert to collect inventory data only was approximately 8 minutes faster than collecting inventory and condition rating data. This difference in average collection rate is likely the result of the added task of performing the condition rating activity.

Participants and Outcomes

The TAMC and CTT worked with forty-nine local agencies that successfully located nearly 50,000 culverts in the 13-week data collection window (April 30 – July 30). This is an impressive level of coordination and cooperation between the TAMC, CTT, and local agencies.

Furthermore, as mentioned previously, TAMC and MDOT staff coordinated reimbursement to the local agencies through the existing Unified Work Program contracts with Michigan's Planning Regions and Metropolitan Planning Agencies. This increased the level of participation from TAMC, CTT, CSS and the 49 local agencies to include all 14 regional planning agencies and 2 metropolitan planning organizations. It is noteworthy to mention that the project included participants representing every planning region in Michigan. Therefore, information gathered in this pilot contains data from both urban and rural areas of the state as well as large road agencies and small villages. For a complete list of participants, please refer to Appendix A; to view a map of the inventoried culverts, please refer to Appendix B.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE EFFORTS

Culture of Asset Management in Michigan

Michigan has had a long history of applying asset management principals to roadway infrastructure. In 2018, the principles of asset management have grown to include a broader set of infrastructure assets. The Michigan legislature established the Michigan Infrastructure Council (MIC) through Public Act 323. The MIC shall develop a multiyear work plan, budget, and funding recommendation for asset management of infrastructure including but not limited to stormwater systems, drains, roads, and bridges. Public Act 324 amended PA 451 to form the Water Asset Management Council (WAMC) which in part will develop templates for the asset management of stormwater systems amongst other assets, including but not limited to culverts and bridges. Lastly, Public Act 325 revises the enacting legislation for the TAMC by, in part, stating that the TAMC shall advise the MIC on infrastructure assets including culverts. Through these acts, the work of the TAMC, and the results of pilot projects like this, the future of asset management for Michigan infrastructure is looking bright.

Key Findings from Pilot

1. The tools, training, business processes, and relationship building that the TAMC initiated for the collection of Pavement Surface Evaluation and Rating (PASER) road condition data has created a strong framework for the rapid collection of other asset data on the local agency road system.
2. The repeating five-year costs associated with training and data collection for a culvert inventory and condition evaluation program are estimated at \$10.5 million to \$11.25 million (\$2.1 million to \$2.5 million annually). These estimates do not include costs associated with development and implementation of asset management programs for culverts.
3. A post-pilot survey showed participant interest in continuing to collect inventory and condition evaluation data on the culverts beyond the pilot timeframe.
4. Inventory data from culverts revealed that the majority (approximately 73 percent) of local agency-owned culverts are small (24 inches in diameter or less), made from corrugated steel, and are circular culverts that are located less than 6 feet from the surface. Larger and more deeply buried culverts are of specific interest because they present a larger consequence of failure in terms of risk to the public and expenditure of funds for repair.
5. Condition data indicates that the local agency-owned culverts are in serviceable shape, with 27 percent of the rated culverts holding condition ratings of 8 or better, and 67.2 percent of the rated culverts holding conditions of 6 or better.

6. It is estimated that it will take approximately \$10 million and more than 131,000 collection team hours to complete the initial data collection of local agency culverts.

Conclusion

This pilot project revealed that the tools, business processes, and relationship building that the TAMC initiated for the collection of PASER road condition data has created a strong framework for the rapid collection of other asset data on the public road system. This is apparent from the significant capabilities that pilot participants demonstrated with their ability to collect a large volume of high-quality asset inventory and condition data in a little over three months. This data was assembled and analyzed using existing business processes and resources. The majority of local agencies used their own forces for collection of data which indicates a domestic capacity to complete this type of activity.

- 49 participating local road agencies
- 13-week data collection window
- 49,644 culverts inventoried
- 90% of local agencies reported using Roadsoft
- 73% of local agency culverts are 24 inches in span or less, 90% are less than 48 inches in span
- 85% are buried 6 feet or less
- 67.2% of rated local agency culverts were 6 or higher out of 10
- Estimated local agency culverts in state – 196,000
- Estimated cost for initial data collection - \$10 million

The culvert pilot final report was submitted to the Governor's office and is available on the TAMC website:

https://www.michigan.gov/documents/tamc/TAMC_2018_Culvert_Pilot_Report_Complete_634795_7.pdf

Recommendations for Future Efforts

In the conclusion section of the full culvert pilot final report, there were a number of recommendations for continuing efforts for managing culvert asset data and the establishment of ongoing training and policy considerations. This is a summary of those recommendations that provide a pathway for future TAMC, MIC, WAMC endeavors to take into account.

- Establish responsibility for division of infrastructure asset management between the TAMC and the WAMC
- The inventory fields established in the pilot should continue to be recommended by the TAMC as a minimum with local agencies expanding on those to meet their needs
- Provide a baseline data model and data standard for culvert data collection
- Training delivery and tool development for asset management should continue
- Continue maintenance of inventory and condition evaluation data
- Promote shared data use – many agencies are interested in some facet of culvert inventory data. Each agency may need to collect specific data but much of the inventory data could be shared between agencies to minimize repeated effort.
- Develop and support a state-wide culvert data collection program

- Future research
 - AASHTO is currently working on an updated condition assessment system which will need to be reviewed, modified if needed, and accepted for use in Michigan.
 - Establish globally unique identification (GUID) for culvert assets to assist in identifying and updating culvert data inventory
 - Create a cost model that relates physical features of culvert inventory to replacement and maintenance costs.

JUSTIFICATION FOR APWA PROJECT OF THE YEAR

TAMC is excited to submit this project for consideration of APWA's Project of the Year under Governmental Cooperation in the Special Projects category. The basis for this pilot effort was, ultimately, the desire to improve knowledge and share tools across all road-owning agencies for the improvement of Michigan's infrastructure regardless of ownership. These are noble and noteworthy aspirations. TAMC members and folks that participated in this effort generally are pleased with the project, its outcomes and what has been learned. Furthermore, from the standpoint of governmental cooperation, this effort was a success in that it involved participants from the village, city, county, region and state level; the project was inclusive in that there were small rural agency participants as well as large, urban agency participants. The project leveraged existing relationships forged in the spirit of data sharing and cooperation, including centralized training, building off established technological platforms for database management. Lastly, the learning from this effort will be incorporated into future public policy and work programs with the intent of improving an easily overlooked element in Michigan's transportation system.

APPENDIX A

Complete list of agencies involved in the project:

Project Sponsor

Transportation Asset Management Council

Managing Agency

Michigan Department of Transportation

Project Consultants

TAMC Bridge Committee

Center for Technology and Training, Michigan Technological University

Center for Shared Solutions, Michigan Department of Technology, Management and Budget

Michigan Department of Transportation

Regional and Metropolitan Planning Organizations

Central Upper Peninsula Planning and Development Regional Commission (CUPPAD – Michigan Planning Region 12)

East Michigan Council of Governments (EMCOG – Region 7)

Eastern Upper Peninsula Regional Planning Development Commission (EUPRPDC – Region 11)

Genesee-Lapeer-Shiawassee Region V Planning Region (GLSRV – Region 5)

Grand Valley Metropolitan Council (GVMC – Grand Rapids Urban Area MPO)

Kalamazoo Area Transportation Study (KATS – Kalamazoo Urban Area MPO)

Northeast Michigan Council of Governments (NEMCOG – Region 9)

Networks Northwest (NNW – Region 10)

Region 2 Planning Commission (R2PC – Region 2)

Southcentral Michigan Planning Council (SCMPC – Region 3)

Southeast Michigan Council of Governments (SEMCOG – Region 1)

Southwest Michigan Planning Commission (SWMPC – Region 4)

Tri-County Regional Planning Commission (TCRPC – Region 6)

West Michigan Regional Planning Commission (WMRPC – Region 8)

West Michigan Shoreline Regional Development Commission (WMSRDC – Region 14)

Western Upper Peninsula Planning and Development Region (WUPPDR – Region 13)

Local Agency Participants

Allegan County Road Commission

Antrim County Road Commission

Baraga County Road Commission

Barry County Road Commission

Bay County Road Commission

Benzie County Road Commission

Cass County Road Commission

City of Benton Harbor

City of Big Rapids
City of Cadillac
City of Coldwater
City of East Tawas
City of Farmington Hills
City of Fenton
City of Munising
City of Muskegon Heights
City of Rochester Hills
City of Tecumseh
City of West Branch
Clinton County Road Commission
Dickinson County Road Commission
Grand Traverse County Road Commission
Hillsdale County Road Commission
Houghton County Road Commission
Huron County Road Commission
Kalkaska County Road Commission
Kent County Road Commission
Lake County Road Commission
Lapeer County Road Commission
Leelanau County Road Commission
Marquette County Road Commission
Mecosta County Road Commission
Midland County Road Commission
Montcalm County Road Commission
Muskegon County Road Commission
Oceana County Road Commission
Oscoda County Road Commission
Ottawa County Road Commission
Roscommon County Road Commission
Saginaw County Road Commission
St. Clair County Road Commission
Tuscola County Road Commission
Van Buren County Road Commission
Village of Caledonia
Village of Daggett
Village of Lennon
Village of Newberry
Village of Walkerville

APPENDIX B

Michigan Map: Culverts Located, Inventoried and Evaluated 2018 Michigan Local Agency Culvert Inventory Pilot

